

**APPENDIX A**  
**ANALYTICAL CHEMISTRY RESULTS**

**APPENDIX A-1**  
**RESULTS OF SEDIMENT CHEMICAL ANALYSES: ORGANICS,**  
**INORGANICS, SEM/AVS, TOC, GRAIN SIZE**

Appendix A-1. Sediment Chemical Analysis Results for the Raymark Phase III Ecological Risk Assessment Investigation.

	C-1-SED-SMP	C-2-SED-SMP	C-3-SED-SMP	C-4-SED-SMP	C-5-SED-SMP	C-6-SED-SMP	C-7-SED-SMP	C-8-SED-SMP	C-9-SED-SMP	C-10-SED-SMP
	DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
%TOC	1.30	3.10	4.10	1.70	3.40	2.00	3.40	1.40		1.50
Metals (mg/kg)										
Arsenic	2.40	9.40	9.10	3.30	6.50	2.90	5.90	1.80		3.80
Cadmium	0.22	0.31	0.42	0.16 J	0.32	2.10	0.63	0.34		0.60
Chromium	25.50	77.20	48.30	14.30	25.80	36.10	172	9.70		51.80
Copper	105	284	504	22.60	73.50	210	155	55.60		266
Lead	37.50	76.60	134	7.30	29.10	87.80	56.30	37.70		41.90
Mercury	0.21	0.59	0.80	0.04	0.69	0.06	0.26	0.12		0.46
Nickel	6.80	17.60	20.20	9.30	18.10	20.70	22.00	5.50		11.20
Silver	0.22	0.57	0.47	0.04 U	0.16 J	0.85	0.41	0.52		0.28
Zinc	68.40	169	243	41.50	118	178	158	56.70		162
Polyaromatic Hydrocarbons (PAHs) (µg/kg)										
1,6,7-Trimethylnaphthalene	3.00	8.00	5.00	1.00 U	1.50 U	88.00	6.00	14.00		15.00
1-Methylnaphthalene	4.00	10.00	8.00	1.00 U	1.50 U	77.00	12.00	13.00		8.00
1-Methylphenanthrene	20.00	58.00	22.00	1.00 U	14.00	410	56.00	40.00		16.00
2,6-Dimethylnaphthalene	4.00	12.00	7.00	1.00 U	1.50 U	95.00	11.00	11.00		13.00
2-Methylnaphthalene	9.00	18.00	14.00	1.00 U	4.00	140	20.00	20.00		15.00
Acenaphthene	4.00	22.00	6.00	1.00 U	3.00	390	76.00	12.00		9.00
Acenaphthylene	23.00	74.00	30.00	1.00 U	18.00	530	45.00	120		48.00
Anthracene	35.00	120	62.00	3.00	39.00	2200	200	180		87.00
Benzo(a)anthracene	130	390	220	9.00	130	5600	490	860		310
Benzo(a)pyrene	120	390	190	7.00	99.00	4400	480	570		300
Benzo(b)fluoranthene	110	510	180	8.00	93.00	6200	650	730		350
Benzo(e)pyrene	98.00	310	180	7.00	74.00	3200	380	360		200
Benzo(g,h,i)perylene	91.00	290	140	6.00	65.00	3000	330	330		180
Benzo(k)fluoranthene	110	120	160	6.00	77.00	1300	180	210		140
Biphenyl	3.00	6.00	8.00	1.00 U	1.50 U	210	6.00	13.00		5.00
Chrysene	120	360	180	8.00	110	4800	470	580		270
Dibenz(a,h)anthracene	18.00	58.00	28.00	1.00 U	14.00	690	74.00	100.00		44.00
Fluoranthene	190	650	310	17.00	200	12000	910	1100		400
Fluorene	5.00	30.00	10.00	1.00 U	4.00	480	54.00	18.00		8.00
Sum PAHs (6 High Molecular Weight) <sup>1</sup>	639	1810	991	56.00	973	29490	2534	3130		1411
Indeno(1,2,3-cd)pyrene	97.00	290	150	6.00	71.00	3700	390	400		210
Sum PAHs (7 Low Molecular Weight) <sup>2</sup>	184	58.00	279	22.00	161	14920	1106	576		340
Naphthalene	12.00	280	27.00	3.00	10.00	210	33.00	26.00		22.00
Phenylene	61.00	52.00	63.00	14.00	420	1200	110	120		87.00
Phenanthrene	96.00 B	56.00 B	130 B	12.00 B	83.00 B	11000 B	770 B	200 B		150 B
Pyrene	200	56.00	370	18.00	180	12000	910	1100		480
Sum PAHs	1563	50.00	2448	134	1714	73890	6613	6947		3378

DO = Data Qualifier: "U"=Undetected; "J"=Estimated; "B"=Below CRDL; and "NA"=Not Analyzed.

One-half the MDL taken where DO = "U".

1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, and Perylene; Perylene not available for Reference

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene.

3 - Sum of Congeners x 2 does not include PCB077, 104, and 154.

4 - Dioxin = 2,3,7,8 TCDD Equivalent; see Appendix D-3.

5 - Reference Station - GAOB (SAIC, 1998). Total PCBs = 16 Congeners x 2.

Appendix A-1. Sediment Chemical Analysis Results for the Raymark Phase III Ecological Risk Assessment Investigation.

	DQ	DQ	DQ	DQ	DQ	DQ	DQ	DQ	DQ	DQ
%TOC	2.80	9.30	28.30	7.00	22.00	4.10	14.30	13.90	5.86	
Metals (mg/kg)										
Arsenic	8.90	13.60	7.70	6.50	8.30	2.90	9.40	4.30	17.90	
Cadmium	2.80	0.04 U	0.03 U	0.12 J	0.05 U	0.80	0.18 J	0.04 U	1.50 B	
Chromium	270	139	53.00	20.80	47.70	36.40	390	47.70	231	
Copper	1560	278	130	36.60	96.40	105	781	174	661	
Lead	165	290	173	89.80	153	189	571	313	158	
Mercury	2.50	0.88	0.27	0.15	0.31	0.19	0.55	0.39	1.20	
Nickel	34.20	26.40	17.10	17.50	19.80	11.50	65.90	23.80	37.40 E	
Silver	1.10	4.50	2.00	0.34	1.10	0.30	1.10	0.50	3.00	
Zinc	780	191	85.50	115	86.80	181	682	378	292	
Polyaromatic Hydrocarbons (PAHs) (µg/g)										
1,6,7-Trimethylnaphthalene	54.00	17.00	10.00 U	27.00	7.50 U	23.00	26.00	100.00		
1-Methylnaphthalene	21.00	32.00	34.00	24.00	17.00	21.00	54.00	220		
1-Methylphenanthrene	66.00	87.00	130	250	83.00	240	260	350		
2,6-Dimethylnaphthalene	42.00	23.00	10.00 U	23.00	7.50 U	33.00	78.00	170		
2-Methylnaphthalene	58.00	50.00	46.00	36.00	25.00	40.00	98.00	130	330 U	
Acenaphthene	32.00	21.00	10.00 U	79.00	7.50 U	35.00	58.00	1100	330 U	
Acenaphthylene	190	260	210	520	130	360	680	940	330 U	
Anthracene	270	270	230	950	150	620	880	3200	330 U	
Benzo(a)anthracene	870	730	890	3300	480	1800	2400	11000	180 J	
Benzo(a)pyrene	840	950	800	2900	540	2000	3300	8700	230 J	
Benzo(b)fluoranthene	990	1400	1100	4400	770	2800	4500	8800	400 XJ	
Benzo(e)pyrene	540	820	960	2300	730	1500	3000	7800		
Benzo(a,h)perylene	490	780	880	1800	820	1400	3200	7200	74.00 J	
Benzo(k)fluoranthene	330	410	930	870	860	710	2600	8500	380 XJ	
Biphenyl	16.00	14.00	10.00 U	86.00	7.50 U	30.00	35.00	340		
Chrysene	770	970	1100	3300	750	1900	2800	8700	220 J	
Dibenz(a,h)anthracene	120	170	170	480	120	320	640	1500	330 U	
Fluoranthene	1200	1800	1700	6200	1200	3200	5700	21000	330 J	
Fluorene	24.00	26.00	10.00 U	140	7.50 U	78.00	84.00	820	330 U	
Sum PAHs (6 High Molecular Weight) <sup>1</sup>	3680	4590	4590	16790	3180	9540	15620	54300	1300	
Indeno(1,2,3-cd)pyrene	570	880	1000	2400	710	1800	3800	8600	110 J	
Sum PAHs (7 Low Molecular Weight) <sup>2</sup>	1024	1863	1443	4288	908	2895	3882	14240	2100	
Naphthalene	80.00	84.00	67.00	41.00	36.00	62.00	200	150	330 U	
Phenanthrene	180	170	160	630	110	420	680	2400		
Pyrene	360 B	960 B	870 B	2600 B	550 B	1500 B	2100 B	7800 B	120 J	
Sum PAHs	8326	12406	12727	30630	6831	23682	42335	127320	7084	

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1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, and Perylene; Perylene not available for Reference

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3 - Sum of Congeners x 2 does not include PCB077,104, and 154.

4 - Dioxin = 2,3,7,8 TCDD Equivalent; see Appendix D-3.

5 - Reference Station - GAOB (BAIC, 1996). Total PCBs = 16 Congeners x 2.

Appendix A-1. Sediment Chemical Analysis Results for the Raymark Phase III Ecological Risk Assessment Investigation.

	C-1-SED-SMP	C-2-SED-SMP	C-3-SED-SMP	D-1-SED-SMP	D-2-SED-SMP	D-3-SED-SMP	D-4-SED-SMP	D-5-SED-SMP	D-6-SED-SMP
	DQ	DQ	DQ	DQ	DQ	DQ	DQ	DQ	DQ
<b>Organochlorine Pesticides (µg/kg)</b>									
Aldrin	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Alpha-BHC	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Alpha-Chlordane	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Beta-BHC	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Delta-BHC	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Dieldrin	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Endosulfan I	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Endosulfan II	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Endosulfan Sulfate	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	1.90	0.55 U	0.42 U	0.40 U
Endrin	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Endrin Aldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC(Lindane)	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Gamma-Chlordane	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Heptachlor	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Heptachlor Epoxide	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Hexachlorobenzene	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Methoxychlor	1.90 U	2.85 U	2.90 U	2.00 U	3.25 U	1.65 U	2.85 U	2.05 U	2.00 U
Mirex	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
o,p'-DDD	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
o,p'-DDE	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
o,p'-DDT	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
o,p'-DDD	0.39 U	3.80	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
o,p'-DDE	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	3.70	20.00	1.60
o,p'-DDT	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	0.42 U	0.40 U
Toxaphene	4.80 U	7.00 U	7.00 U	5.00 U	8.00 U	0.33 U	0.55 U	0.42 U	0.40 U
<b>Polychlorinated Biphenyls (PCBs) (µg/kg)</b>									
PCB008	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	320	0.40 U
PCB018	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB028	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	2.50	41.00	1.30
PCB029	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB044	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	4.50	230	0.40 U
PCB050	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB052	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	3.90	1000	2.30
PCB066	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	2.90	8.20	20.50 U	0.40 U
PCB077	0.39 U	3.50	0.60 U	0.40 U	0.65 U	4.70	0.55 U	20.50 U	0.40 U
PCB087	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB101	4.70	8.70	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB104	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	17.00	160	0.40 U
PCB105	0.95	4.80	2.20	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB118	0.97	1.80	0.60 U	0.40 U	0.65 U	1.20	2.80	20.50 U	1.70
PCB126	0.39 U	2.40	3.20	0.40 U	0.65 U	5.10	3.50	120	0.40 U
PCB128	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	1.30	20.50 U	0.40 U
PCB138	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB153	0.94	2.20	0.60 U	0.40 U	0.65 U	1.70	4.10	150	1.40
PCB154	1.10	4.70	0.60 U	0.40 U	0.65 U	1.10	5.00	150	2.20
PCB170	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	2.00	0.55 U	20.50 U	0.40 U
PCB180	0.39 U	12.00	0.60 U	0.40 U	0.65 U	2.80	0.55 U	20.50 U	0.40 U
PCB187	2.40	7.40	8.00	0.40 U	0.65 U	0.33 U	9.00	49.00	3.90
PCB188	1.50	8.40	4.90	0.40 U	0.65 U	0.33 U	5.10	20.50 U	3.20
PCB195	0.39 U	1.60	0.60 U	0.40 U	0.65 U	1.40	1.90	20.50 U	1.20
PCB200	0.39 U	4.20	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	1.10
PCB208	0.39 U	0.55 U	0.60 U	0.40 U	0.65 U	0.33 U	0.55 U	20.50 U	0.40 U
PCB209	0.39 U	10.00	0.60 U	0.40 U	0.65 U	0.33 U	20.00	20.50 U	4.00
PCB209	0.39 U	6.80	0.60 U	0.40 U	3.00	0.33 U	0.55 U	20.50 U	0.40 U
Total PCBs (Sum of Congeners x 2)*	38.21	159	80.80	19.20	35.90	43.65	188	5055	55.80
<b>Dioxins* (ng/kg)</b>									
Dioxin-Mammal	4.61	13.38	10.04	2.34	2.83	25.62	13.36	227	5.07
Dioxin-Fish	4.30	11.82	8.17	2.23	2.56	23.38	12.12	223	4.84
Dioxin-Bird	6.34	22.78	19.57	2.53	3.71	37.49	25.36	324	8.24

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Dibenz(a,h)anthracene, Fluoranthene, and Perylene; Perylene not available for Reference

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene,

Fluorene, Naphthalene, and Phenanthrene.

3 - Sum of Congeners x 2 does not include PCB077, 104, and 154.

4 - Dioxin = 2,3,7,8 TCDD Equivalent; see Appendix D-3.

5 - Reference Station - GMDs (SAIC, 1998). Total PCBs = 16 Congeners x 2.

Appendix A-1. Sediment Chemical Analysis Results for the Raymark Phase III Ecological Risk Assessment Investigation.

	D-4-SED-FD		E-1-SED-SMP		E-2-SED-SMP		E-3-SED-SMP		E-4-SED-SMP		F-1-SED-SMP		F-2-SED-SMP		F-3-SED-SMP		Reference <sup>5</sup>	
	DO		DO		DO		DO		DO		DO		DO		DO		DO	
<b>Organochlorine Pesticides (µg/kg)</b>																		
Aldrin	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Alpha-BHC	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Alpha-Chlordane	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Beta-BHC	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Delta-BHC	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Dieldrin	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Endosulfan I	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Endosulfan II	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Endosulfan Sulfate	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Endrin	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Endrin Aldehyde	NA		NA		NA		NA		NA		NA		NA		NA			
Gamma-BHC(Lindane)	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Gamma-Chlordane	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Heptachlor	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Heptachlor Epoxide	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Hexachlorobenzene	0.55	U	11.00		4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Methoxychlor	2.70	U	6.00	U	20.50	U	4.65	U	15.00	U	4.45	U	13.50	U	18.00	U		
Mirex	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
o,p'-DDD	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
o,p'-DDE	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	7.30		2.70	U	3.60	U		
o,p'-DDT	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
p,p'-DDD	0.55	U	1.25	U	23.00		0.90	U	24.00		36.00		70.00		120			
p,p'-DDE	0.55	U	1.25	U	4.10	U	4.00		3.05	U	0.90	U	30.00		90.00			
p,p'-DDT	0.55	U	1.25	U	4.10	U	0.90	U	3.05	U	4.20		24.00		3.60	U		
Toxaphene	7.00	U	15.50	U	50.00	U	11.50	U	36.00	U	11.00	U	33.50	U	45.00	U		
<b>Polychlorinated Biphenyls (PCBs) (µg)</b>																		
PCB008	0.55	U	170		4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB018	0.55	U	3000		4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB028	0.55	U	1700		28.00		0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB029	0.55	U	80.00	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB044	0.55	U	820		19.00		0.90	U	15.00		0.90	U	2.70	U	25.00			
PCB050	0.55	U	80.00	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB052	0.55	U	2000		23.00		0.90	U	9.80		0.90	U	2.70	U	3.60	U		
PCB066	1.90		2100		54.00		0.90	U	32.00		0.90	U	5.40		3.60	U		
PCB077	0.55	U	80.00	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB087	0.55	U	880		20.00		0.90	U	3.05	U	0.90	U	2.70	U	9.40			
PCB101	0.55	U	2700		53.00		0.90	U	18.60		0.90	U	170		16.00			
PCB104	0.55	U	80.00	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB105	0.55	U	590		36.00		0.90	U	16.00		13.00		28.00		98.00			
PCB118	0.55	U	1800		36.00		0.90	U	14.00		0.90	U	24.00		33.00			
PCB126	0.55	U	140		4.10	U	0.90	U	3.05	U	0.90	U	9.30		18.00			
PCB128	0.55	U	520		4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB138	0.55	U	1900		42.00		5.80		15.00		9.20		21.00		20.00			
PCB153	0.55	U	1500		37.00		8.40		12.00		5.70		23.00		45.00			
PCB154	0.55	U	80.00	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB170	0.55	U	400		4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB180	7.70		330		21.00		0.90	U	12.00		17.00		50.00		3.60	U		
PCB187	3.50		150		13.00		13.00		9.70		16.00		40.00		29.00			
PCB188	1.50		210		4.10	U	0.90	U	3.05	U	5.80		11.00		20.00			
PCB195	2.00		60.00	U	4.10	U	0.90	U	3.05	U	4.50		5.40		3.60	U		
PCB200	0.55	U	80.00	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
PCB206	5.10		80.00	U	16.00		0.90	U	3.05	U	30.00		31.00		15.00			
PCB209	0.55	U	80.00	U	4.10	U	0.90	U	3.05	U	0.90	U	2.70	U	3.60	U		
Total PCBs (Sum of Congeners x 2) <sup>3</sup>	63.20		41680		888		82.20		392		231		919		750		75.17	
<b>Dioxins<sup>4</sup> (ng/kg)</b>																		
Dioxin-Mammal	13.50		231		32.70		14.46		36.44		13.54		43.38		18.63		8.07	
Dioxin-Fish	13.23		203		29.48		14.11		32.37		12.08		35.08		15.29		7.57	
Dioxin-Bird	22.14		440		58.08		23.75		47.03		26.33		66.96		25.14		16.75	

DO = Data Outlier; "U"=Undetected; "E"=Estimated; "B"=Below CRDL; and "NA"=Not Analyzed.

One-half the MDL taken where DO = "U".

1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene,

Dibenz(a,h)anthracene, Fluoranthene, and Perylene; Perylene not available for Reference

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene.

3 - Sum of Congeners x 2 does not include PCB077,104, and 154

4 - Dioxin = 2,3,7,8-TCDD (provided, see Appendix 11-3)

5 - Reference Status - GMD8 (SAC, 1998) Total PCBs = 16 Congeners x 2.

Appendix A-1. Sediment Chemical Analysis Results for the Raymark Phase III Ecological Risk Assessment Investigation.

	C-1-SED-SMP DQ	C-2-SED-SMP DQ	C-3-SED-SMP DQ	D-1-SED-SMP DQ	D-2-SED-SMP DQ	D-3-SED-SMP DQ	D-4-SED-SMP DQ	D-5-SED-SMP DQ	D-6-SED-SMP DQ
AVS/SEM ( $\mu\text{mol/g dry wt}$ )									
Acid Volatile Sulfide	11.81	16.22	0.30	<0.1	4.29	1.79	13.95	2.62	5.68
Cadmium	1.00E-03 J	1.00E-03 J	2.00E-03	1.00E-03 J	2.00E-03 J	9.00E-03	4.00E-03	2.00E-03	3.00E-03
Copper	0.05 J	0.12 J	0.39 J	0.06 J	0.05 J	0.76 J	0.57 J	0.10 J	0.07 J
Lead	0.07 J	0.15 J	0.26 J	0.02 J	0.05 J	0.29 J	0.17 J	0.13 J	0.09 J
Nickel	0.05 J	0.09 J	0.08 J	0.05 J	0.06 J	0.28 J	0.83 J	0.37 J	0.35 J
SEM-AVS	-8.49	-10.99	4.64	n/a	-1.36	5.23	-12.48	-0.32	-1.57
SEM/AVS	0.20	0.32	16.45	n/a	0.68	3.92	0.11	0.88	0.72
Zinc	2.14 J	4.87 J	4.21 J	0.55 J	2.75 J	5.68 J	0.10 J	1.70 J	3.60 J
Grain Size (%)									
Clay	0.30	1.20	1.00	0.20	0.70	0	1.10	0	0.20
Sand	78.60	43.70	26.90	59.40	31.20	98.30	40.70	93.20	79.00
Silt	21.10	55.10	72.10	40.40	68.10	1.70	58.10	6.70	20.80

DQ = Data Qualifier: "U"=Undetected; "J"=Estimated; "B"=Below CRDL; and "NA"=Not Analyzed.

One-half the MDL taken where DQ = "U".

1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, and Perylene; Perylene not available for Reference

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene.

3 - Sum of Congeners x 2 does not include PCB077, 104, and 154.

4 - Dioxin = 2,3,7,8 TCDD Equivalent; see Appendix D-3.

5 - Reference Station - GMD6 (SAIC, 1998). Total PCBs = 16 Congeners x 2.

Appendix A-1. Sediment Chemical Analysis Results for the Raymark Phase III Ecological Risk Assessment Investigation.

	D-4-SED-FD DQ	E-1-SED-SMP DQ	E-2-SED-SMP DQ	E-3-SED-SMP DQ	E-4-SED-SMP DQ	F-1-SED-SMP DQ	F-2-SED-SMP DQ	F-3-SED-SMP DQ	Reference <sup>5</sup> DQ
AVS/SEM (μmol/g dry wt)									
Acid Volatile Sulfide	12.52	22.22	18.77	<0.1	13.38	124	83.45	27.01	0.40
Cadmium	7.00E-03	#####	#####	#####	4.00E-03	0.02	0.05	0.02	0.01
Copper	0.17 J	1.80 J	2.33 J	1.05 J	2.82 J	0.30 J	0.11 J	0.78 J	0.32
Lead	0.27 J	1.19 J	0.48 J	0.31 J	0.55 J	0.88 J	1.84 J	1.31 J	0.41
Nickel	0.54 J	1.83 J	0.31 J	0.29 J	0.45 J	0.34 J	0.78 J	1.12 J	0.15
SEM-AVS	-2.68	-2.38	0.35	n/a	-8.25	-112.11	-63.73	-5.78	-4.87
SEM-AVS	0.79	0.88	1.02	n/a	0.53	0.10	0.24	0.79	0.48
Zinc	8.88 J	15.21 J	14.00 J	4.81 J	3.50 J	10.87 J	17.13 J	18.01 J	3.63
Grain Size (%)									
Clay	0.50	1.10	1.70	0.80	2.10	0.40	2.00	1.10	0
Sand	41.30	7.30	5.90	40.50	4.80	80.80	18.40	58.70	78.33
Silt	58.20	91.60	92.50	58.70	93.30	18.70	79.60	42.20	21.67

DQ = Data Qualifier: "U"=Undetected; "J"=Estimated; "B"=Below CRDL; and "NA"=Not Analyzed.  
One-half the MDL taken where DQ = "U".

1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene,

Dibenz(a,h)anthracene, Fluoranthene, and Perylene; Perylene not available for Reference

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene.

3 - Sum of Congeners x 2 does not include PCB077, 104, and 154.

4 - Dioxin = 2,3,7,8 TCDD Equivalent; see Appendix D-3.

5 - Reference Station - GMS (SAIC, 1998). Total PCBs = 16 Congeners x 2.



**APPENDIX A-2**  
**RESULTS OF POREWATER CHEMICAL ANALYSES:**  
**METALS**

Appendix A-2. Sediment Porewater Analysis Results for the Raymark Phase III Ecological Risk Assessment Investigation.

	C-1-PW	DQ	C-2-PW	DQ	C-3-PW	DQ	D-1-PW	DQ	D-2-PW	DQ	D-3-PW	DQ	D-4-PW	DQ	D-5-PW	DQ	D-6-PW	DQ	D-6-FD	DQ	E-1-PW	DQ	E-2-PW	DQ	E-3-PW	DQ	E-4-PW	DQ	F-1-PW	DQ	F-2-PW	DQ	F-3-PW	DQ	Reference	DQ
Metals (mg/kg)																																				
Arsenic	42.9		12.4		5.0	U,UJ	5.0	U,UJ	5.0	U,UJ	5.0	U,UJ	5.0	U,UJ	5.0	U,UJ	5.0	U,B	10.5		29.1		10.3		5.0	U,UJ	5.0	U,UJ	5.0	U,UJ	10.5		20.10			
Cadmium	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.4		0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.1	U,B	0.17			
Chromium	3.8		9.3		2.0		0.4	U,B	1.5		0.4	U,B	2.5		1.4		1.0		5.1		2.9		13.7		1.0		3.4		1.5		3.5		0.6		1.69	
Copper	1.3	U	1.3	U	1.3	U	1.3	U	2.9		11.2		1.3	U	1.3	U	1.3	U	1.3	U	20.8		15.4		5.1		2.9		1.3	U	5.9		1.3	U	55.00	
Lead	1.45	U,UJ	1.45	U,UJ	3.3	J	3.2	J	1.45	U,J	3.7	J	1.45	U,UJ	1.45	U,UJ	1.45	U,UJ	1.45	U,UJ	34.8		1.45	U,UJ	3.7	J	1.45	U,UJ	1.45	U,UJ	1.45	U,UJ	1.45	U,UJ	1.56	
Mercury	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Nickel	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	4	U,B	8.3		9.9		4	U,B	4	U,B	4	U,B	32.00	
Silver	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	0.3	U,UJ	1.00E-03	
Zinc	1.5	U,B	5.5	J	12.7	J	17.9	J	1.5	U,B	32.7	J	9.2	J	6.8	J	4.1	J	16.1	J	1.5	U,B	1.5	U,B	7.9	J	11.6	J	9.4	J	26.8	J	4.5	J	420	

U = Concentrations in ug/L below the Limit of Quantitative Detection (LOQ) value rounded = 10 U LOQ

U = Concentrations in µg/L, below the Limit of Quantitative Detection (LOQ); value reported = 1/2 LOQ.

B = Below the Contract Required Detection Limit.

UJ = Uncertainty associated with the reported detection limits.

J = Estimated.

1 - Reference Station - GM08 (SAC, 1998).

**APPENDIX A-3**  
**RESULTS OF TISSUE CHEMICAL ANALYSES:**  
**ORGANICS, METALS, AND LIPIDS**

Appendix A-3. Concentrations of CoCs in Ribbed Mussels collected for the Raymark Phase III Ecological Risk Assessment Investigation.

	C-1-TSS-SMP	DQ	C-2-TSS-SMP	DQ	C-3-TSS-SMP	DQ	C-1-TSS-SMP	DQ	C-2-TSS-SMP	DQ	C-3-TSS-SMP	DQ	C-4-TSS-SMP	DQ	C-5-TSS-SMP	DQ	C-6-TSS-SMP	DQ	C-7-TSS-SMP	DQ
Lipid Content	2.00		1.40		2.80		3.90		4.00		2.00		3.10		2.60		2.20			
<b>Metals (mg/kg dw)</b>																				
Arsenic	2.00	J	2.20	J	2.10	J	1.80	J	2.60	J	3.80	J	3.20	J	2.70	J	2.30	J		
Cadmium	0.44	J	0.67	J	0.51	J	0.74	J	0.49	J	0.99	J	0.57	J	1.10	J	0.58	J		
Chromium	1.20		1.70		2.30		1.00		0.85		1.00		1.80		2.80		1.20			
Copper	24.20		42.60		37.10		16.70		19.90		18.10		20.50		29.80		26.30			
Lead	1.10		1.60		2.20		0.95		0.69		0.93		1.00		1.60		1.00			
Mercury	0.10		0.11		0.10		0.09		0.09		0.10		0.10		0.14		0.10			
Nickel	0.84		0.73		0.62		0.50		0.52		0.57		0.69		0.75		0.51			
Silver	1.20		1.90		1.10		0.65		1.00		0.91		1.10		0.84		1.10			
Zinc	68.20		80.50		58.20		59.10		58.40		68.80		66.50		70.00		62.90			
<b>Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg dw)</b>																				
1,6,7-Trimethylnaphthalene	5.50	U	5.50	U	5.50	U	5.00	U	5.00	U	5.50	U	6.50	U	6.00	U	5.50	U		
1-Methylnaphthalene	90.00		97.00		110		97.00		140		94.00		160		83.00		70.00			
1-Methylphenanthrene	5.50	U	5.50	U	5.50	U	5.00	U	6.00	U	5.50	U	6.50	U	6.00	U	5.50	U		
2,6-Dimethylnaphthalene	5.50	U	5.50	U	5.50	U	5.00	U	20.00		5.50	U	6.50	U	6.00	U	5.50	U		
2-Methylnaphthalene	91.00		85.00		110		130		160		100.00		140		110		80.00			
Acenaphthene	23.00		15.00		17.00		25.00		24.00		19.00		29.00		16.00		12.00			
Acenaphthylene	5.50	U	5.50	U	12.00		14.00		15.00		5.50	U	14.00		6.00	U	5.50	U		
Anthracene	5.50	U	5.50	U	5.50	U	12.00		12.00		5.50	U	6.50	U	6.00	U	5.50	U		
Benzo(a)anthracene	15.00		13.00		28.00		26.00		32.00		14.00		22.00		22.00		17.00			
Benzo(a)pyrene	5.50	U	5.50	U	13.00		5.00	U	5.00	U	5.50	U	6.50	U	6.00	U	5.50	U		
Benzo(b)fluoranthene	6.50	U	6.50	U	17.00		14.00		21.00		5.50	U	6.50	U	6.00	U	5.50	U		
Benzo(c)pyrene	5.50	U	6.50	U	15.00		24.00		27.00		5.50	U	20.00		18.00		17.00			
Benzo(g,h,i)perylene	5.50	U	5.50	U	19.00		5.00	U	15.00		5.50	U	6.50	U	6.00	U	5.50	U		
Benzo(k)fluoranthene	5.50	U	5.50	U	17.00		11.00		18.00		5.50	U	6.50	U	6.00	U	5.50	U		
Biphenyl	5.50	U	5.50	U	5.50	U	5.00	U	5.00	U	5.50	U	6.50	U	6.00	U	5.50	U		
Chrysene	12.00		5.50	U	22.00		20.00		28.00		5.50	U	15.00		15.00		16.00			
Dibenz(a,h)anthracene	5.50	U	6.50	U	12.00		5.00	U	5.00	U	5.50	U	6.50	U	6.00	U	5.50	U		
Fluoranthene	33.00		25.00		44.00		74.00		71.00		32.00		54.00		41.00		37.00			
Fluorene	5.50	U	5.50	U	13.00		16.00		18.00		11.00		17.00		6.00	U	5.50	U		
Sum PAHs (6 High Molecular Weight) <sup>1</sup>	78.50		80.00		122		135		152		68.00		111		96.00		86.50			
Indeno(1,2,3-cd)pyrene	5.50	U	5.50	U	18.00		5.00	U	5.00	U	5.50	U	6.50	U	6.00	U	5.50	U		
Sum PAHs (7 Low Molecular Weight) <sup>2</sup>	405		383		472		482		572		406		577		368		306			
Naphthalene	210		210		230		200		250		190		260		180		140			
Phenanthrene	6.50	U	5.50	U	5.50	U	5.00	U	11.00		5.50	U	6.50	U	6.00	U	5.50	U		
Phenanthrene	84.00		56.00		84.00		85.00		93.00		75.00		110		64.00		59.00			
Pyrene	63.00		57.00		83.00		150		140		73.00		100.00		100.00		68.00			
Sum PAHs	884		846		892		943		1125		691		1019		743		593			

DQ = Data Qualifier: "U"=Undetected; "J"=Estimated; "B"=Below CRDL; and "NA"=Not Analyzed.

Tissue sample analyzed = ribbed mussels.

One-half the MDL taken where DQ = "U".

1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, and Perylene.

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene.

3 - Sum of Congeners x 2 does not include PCB077,104, and 154.

Appendix A-3. Concentrations of CoCs in Ribbed Mussels collected for the Raymark Phase III Ecological Risk Assessment Investigation.

	C-1-TSS-SMP		C-2-TSS-SMP		C-3-TSS-SMP		C-1-TSS-SMP		D-2-TSS-SMP		D-3-TSS-SMP		D-4-TSS-SMP		D-4-TSS-SMP		D-4-TSS-SMP		D-4-TSS-SMP	
	DO		DO		DO		DO		DO		DO		DO		DO		DO		DO	
<b>Organochlorine Pesticides (<math>\mu\text{g/kg dw}</math>)</b>																				
Aldrin	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Alpha-BHC	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Alpha-Chlordane	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Beta-BHC	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Delta-BHC	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Dieldrin	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Endosulfan I	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Endosulfan II	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Endosulfan Sulfate	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Endrin	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Endrin Aldehyde	NA		NA		NA		NA		NA		NA		NA		NA		NA			
Gamma-BHC(Lindane)	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Gamma-Chlordane	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Heptachlor	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Heptachlor Epoxide	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Hexachlorobenzene	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Methoxychlor	5.50	U	5.50	U	5.50	U	4.90	U	5.00	U	5.50	U	6.50	U	6.00	U	5.00	U		
Mirex	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
o,p'-DDD	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
o,p'-DDE	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
o,p'-DDT	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
o,p'-DDD	2.30	U	2.20	U	6.80	U	16.00	U	8.40	U	2.15	U	2.80	U	2.50	U	2.10	U		
o,p'-DDE	2.30	U	2.20	U	2.15	U	8.40	U	7.10	U	2.15	U	2.80	U	2.50	U	2.10	U		
o,p'-DDT	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Toxaphene	14.50	U	13.50	U	13.50	U	12.00	U	12.50	U	13.50	U	16.00	U	15.50	U	13.00	U		
<b>Polychlorinated Biphenyls (PCBs) (<math>\mu\text{g/kg dw}</math>)</b>																				
PCB008	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB018	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB028	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB029	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB044	2.30	U	2.20	U	2.15	U	16.00	U	6.30	U	2.15	U	8.90	U	2.50	U	2.10	U		
PCB050	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB052	2.30	U	2.20	U	2.15	U	6.80	U	5.00	U	2.15	U	7.70	U	2.50	U	2.10	U		
PCB066	2.30	U	2.20	U	2.15	U	6.80	U	9.20	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB077	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB087	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB101	2.30	U	2.20	U	10.00	U	15.00	U	16.00	U	6.00	U	11.00	U	9.50	U	4.50	U		
PCB104	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB105	2.30	U	2.20	U	2.15	U	4.50	U	5.90	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB118	2.30	U	2.20	U	2.15	U	1.95	U	4.90	U	2.15	U	6.70	U	6.00	U	2.10	U		
PCB126	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB128	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB138	2.30	U	2.20	U	2.15	U	12.00	U	10.00	U	2.15	U	8.80	U	7.20	U	6.00	U		
PCB153	2.30	U	2.20	U	7.80	U	13.00	U	21.00	U	8.00	U	16.00	U	14.00	U	7.40	U		
PCB154	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB170	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB180	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB187	2.30	U	2.20	U	8.40	U	16.00	U	11.00	U	4.50	U	11.00	U	6.00	U	6.10	U		
PCB188	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	4.40	U		
PCB195	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB200	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB206	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
PCB209	2.30	U	2.20	U	2.15	U	1.95	U	2.00	U	2.15	U	2.80	U	2.50	U	2.10	U		
Sum of Congeners x 2 <sup>3</sup>	110		108		145		243		239		128		227		184		137			

DO = Data Qualifier; "U" = Undetected; "E" = Estimated; "B" = Below CRDL; and "NA" = Not Analyzed.

Tissue sample analyzed = ribbed mussels.

One-half the MDL taken where DO = "U".

1 - Sum of High Molecular Weight PAHs = Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, and Perylene.

2 - Sum of Low Molecular Weight PAHs = 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene.

3 - Sum of Congeners x 2 does not include PCB077, 104, and 154.

**APPENDIX B  
EFFECTS DATA**

**APPENDIX B-1**  
**TOXICOLOGICAL EVALUATION OF SEVENTEEN SEDIMENTS:**  
**RAYMARK 1999**

**TOXICOLOGICAL EVALUATION  
OF SEVENTEEN SEDIMENTS:**

**Raymark 1999**

**Prepared For:**

**Science Applications International Corporation  
221 Third Street  
Admiral's Gate  
Newport, Rhode Island 02840**

**Prepared By:**

**EnviroSystems, Incorporated  
1 Lafayette Road  
Hampton, New Hampshire 03842**

**May 5, 1999  
Reference SAIC7814-99-04**



## TOXICOLOGICAL EVALUATION

### OF SEVENTEEN SEDIMENTS:

Raymark 1999

#### 1.0 SAMPLE RECEIPT AND STORAGE

Seventeen (17) sediments were collected by Science Applications International Corporation (SAIC), Newport, Rhode Island on April 16, 1999. Each sample was placed in a one gallon polyethylene jug and shipped on ice to EnviroSystems, Incorporated (ESI), Hampton, New Hampshire. Samples were received at ESI on April 20, 1999. Control sediment for the amphipod assay was provided by the organism supplier.

At ESI, samples were given identification numbers and refrigerated at 2-4 °C until test initiation.

#### 2.0 TEST ORGANISMS

The 10 day acute solid phase assay was conducted using *Ampelisca abdita*, obtained from Eastern Aquatic Biosupply of Kingstown, Rhode Island. Prior to use, test organisms were held for two days under conditions of temperature, salinity, and photoperiod similar to those to be used in the assay. *A. abdita* used in the assay were adults between 2 and 3 mm in length.

#### 3.0 TEST METHODOLOGY

##### 3.1 April 21, 1999 (Day -2)

Test and control sediments were all sieved (1 mm) to remove macroinvertebrates, large shell hash, and rocks prior to use in the assays. Each test sediments consisted on five replicates. Each replicate contained approximately 175 mL of sediment and 725 mL of natural sea water in a 1 liter beaker. The overlying water in each test vessel was gently aerated and test chambers were allowed to stabilize overnight.

Client: Science Applications International Corporation.  
Date: April 23, 1999

Project: Raymark 1999.  
Study: 7814.

### 3.2 April 22, 1999 (Day -1)

A pore water ammonia sample was taken and measured for one replicate of each test sediment. As the level of un-ionized ammonia in the pore water was  $\leq 0.2$  mg/L (half of the acute LC-50 value of 0.40 mg/L for the amphipod, *Ampelisca abdita*) the sediments did not need to be "washed" to reduce total ammonia levels. The concentration of un-ionized ammonia was determined based on ammonia concentrations, temperature, and pH using tables provided by the U.S. EPA (1979). (Salinity was not factored into the determination of percent un-ionized ammonia. Information provided in the U.S. EPA document indicated that the effect of salinity on percent un-ionized ammonia in the sample was small.)

### 3.3 April 23, 1999 (Day 0)

Pore water ammonia samples were taken and measured. Dissolved oxygen, temperature, pH, and salinity in aliquots of overlying water from each test vessel were recorded. It was noted that the pH of the overlying water for sediment "E-4-SED-SMP," ranged from 3.71 SU to 4.41 SU. To minimize the impact low pH could have on organism survival, the overlying water in these test replicates was decanted, replenished, and allowed to settle for a minimum of four hours.

A total of 20 amphipods were indiscriminately selected from the pool of organisms and randomly added to each test and control sediment replicate. Five true replicates were used for each treatment. Water temperature was  $20 \pm 2^\circ\text{C}$ , and the salinity regime was established at  $28 \pm 2\%$ . The photoperiod was set at 24 hours light and 0 hours dark.

### 3.4 April 24, 199 - May 2, 1999 (Days 1-9)

Temperature, salinity, pH, and dissolved oxygen in each test replicate were recorded daily. In cases where salinity exceed 30 ppt overnight, salinity was corrected to  $28 \pm 2$  ppt using spring water. Overlying water lost to evaporation was replenished as needed. Samples were not renewed during the ten day exposure period.

On Day 2, the pH values of overlying water for the E-4-SED-SMP sediment ranged from 5.04 to 6.84 SU. In this case, the overlying water was decanted and replaced taking care not to disturb the test organisms.

Client: Science Applications International Corporation.  
Date: April 23, 1999

Project: Raymark 1999.  
Study: 7814.

### 3.5 May 3, 1999 (Day 10)

Temperature, salinity, pH, and dissolved oxygen in each test replicate were recorded. The test sediment from each replicate was sifted using a 750  $\mu$  sieve, organisms were recovered, and survival was recorded.

### 4.0 REFERENCE TOXICANT EVALUATION

As part of the laboratory quality control program, reference toxicant evaluations are conducted on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. A reference toxicant assay was conducted on April 27, 1999 using cadmium chloride. The assay resulted in a 96 hour LC-50 value of 0.1 mg/L Cadmium (Probit Analysis). This value was within one standard deviation of the historic mean for the species.

### 5.0 LITERATURE CITED

U.S. EPA 1979. Aqueous Ammonia Equilibrium - Tabulation of Percent Unionized Ammonia. EPA-600/3-79/091. 437 pages

CLIENT: SAIC  
 STUDY: 7814  
 PROJECT: RAYMARK 1999  
 PARAMETER: Ampelisa abdita 10 Day Chronic Assay Survival

SITE	SURVIVAL Replicate					MEAN
	A	B	C	D	E	
LAB CONTROL	90%	100%	90%	80%	100%	92%
C-1-SED-SMP	65%	65%	45%	25%	45%	49%
C-2-SED-SMP	70%	60%	75%	15%	25%	49%
C-3-SED-SMP	5%	15%	10%	0%	0%	6%
D-1-SED-SMP	85%	90%	85%	45%	60%	73%
D-2-SED-SMP	75%	80%	70%	25%	25%	55%
D-3-SED-SMP	50%	60%	50%	35%	35%	46%
D-4-SED-SMP	70%	80%	60%	55%	20%	57%
D-5-SED-SMP	60%	85%	50%	60%	60%	63%
D-6-SED-SMP	0%	15%	0%	0%	0%	3%
D-6-SED-FD	0%	0%	0%	0%	0%	0%
E-1-SED-SMP	55%	70%	75%	45%	70%	63%
E-2-SED-SMP	60%	80%	55%	55%	40%	58%
E-3-SED-SMP	80%	95%	55%	70%	40%	68%
E-4-SED-SMP	40%	50%	65%	45%	25%	45%
F-1-SED-SMP	45%	50%	65%	70%	45%	55%
F-2-SED-SMP	85%	60%	75%	80%	80%	76%
F-3-SED-SMP	70%	60%	80%	65%	50%	65%

**COMMENTS:**

Survival in Replicate "E" from the laboratory control sediment is based on recovery of 10 organisms from an original 10 added to the test vessel.

CLIENT: SAIC  
STUDY: 7814  
PROJECT: RAYMARK 1999  
PARAMETER: Ammonia Data

SITE	Ammonia Concentration, mg/L			
	Exposure (Day)			
	-1	0	5	10
LAB CONTROL	0.40	0.81	0.70	<0.05
C-1-SED-SMP	2.92	2.87	4.30	2.58
C-2-SED-SMP	1.93	2.42	3.52	0.44
C-3-SED-SMP	0.72	1.02	1.40	<0.05
D-1-SED-SMP	0.08	0.06	0.59	0.45
D-2-SED-SMP	1.70	0.94	2.51	0.11
D-3-SED-SMP	1.61	3.28	1.74	<0.05
D-4-SED-SMP	1.35	1.12	5.88	2.00
D-5-SED-SMP	4.01	<0.05	2.32	<0.05
D-6-SED-SMP	1.50	1.82	3.03	<0.05
D-6-SED-FD	1.71	1.89	4.36	1.43
E-1-SED-SMP	2.68	1.41	<0.05	2.66
E-2-SED-SMP	4.91	3.90	<0.05	2.80
E-3-SED-SMP	4.67	2.78	<0.05	3.28
E-4-SED-SMP	2.57	2.52	2.04	2.00
F-1-SED-SMP	3.45	4.71	3.81	3.82
F-2-SED-SMP	5.24	3.07	4.08	5.80
F-3-SED-SMP	4.22	4.28	4.87	5.32

COMMENTS:

Ammonia on Days -1 and 0 were measured on aliquots of pore water.  
Ammonia on Days 5 and 10 were measured on aliquots of the overlying water.

CLIENT: SAIC  
 STUDY NUMBER: 7814  
 PROJECT: RAYMARK 1999  
 PARAMETER: Water Quality Data

CONTROL:

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.6	7.93	30	22	6.8	7.94	30	22	6.9	7.96	30	22	6.9	7.95	30	22	6.9	7.95	30
1	22	6.4	7.77	32	22	6.7	7.92	32	22	6.8	7.86	32	22	6.8	7.86	32	22	6.8	7.77	32
2	22	7.2	7.92	29	22	7.2	7.94	30	22	7.1	7.98	30	22	7.0	7.98	30	22	6.9	7.95	30
3	22	7.5	7.98	29	22	7.5	7.98	28	22	7.6	7.97	29	22	7.5	7.94	28	22	7.6	7.95	29
4	22	7.0	7.87	31	22	6.8	7.89	31	22	6.8	7.90	30	22	6.8	7.83	31	22	6.7	7.88	31
5	22	7.0	8.07	30	22	6.9	8.00	30	22	6.8	7.99	30	22	6.7	8.03	30	22	6.8	8.09	30
6	22	7.1	7.98	30	22	7.1	7.97	30	22	7.1	7.96	30	22	7.1	7.95	30	22	7.1	7.96	30
7	22	7.1	7.87	30	22	7.1	7.86	30	22	7.1	7.86	30	22	7.1	7.86	30	22	7.1	7.91	30
8	21	7.2	7.90	29	21	7.2	6.92	29	21	7.2	6.87	28	21	7.2	7.08	29	21	7.1	7.96	31
9	21	5.9	8.03	30	21	5.9	8.06	30	21	6.1	8.06	29	21	6.1	8.07	28	21	6.3	8.07	29
10	21	6.3	8.18	30	21	6.4	8.19	30	21	6.4	8.17	30	21	6.4	8.17	30	21	6.3	8.17	30

C-1-SED-SMP

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.8	8.01	29	22	6.8	8.01	29	22	6.8	7.99	29	22	6.7	8.00	29	22	6.7	8.02	29
1	22	6.6	7.99	31	22	6.4	8.01	31	22	6.4	8.01	31	22	6.4	8.00	31	22	6.3	8.01	31
2	22	6.8	8.00	30	22	7.0	8.10	29	22	6.9	8.10	29	22	6.9	8.10	28	22	6.9	8.09	28
3	22	7.4	8.12	29	22	7.4	8.12	27	22	7.4	8.12	29	22	7.3	8.11	27	22	7.4	8.10	29
4	22	6.8	8.12	31	22	6.9	8.16	31	22	6.6	8.15	30	22	6.8	8.14	31	22	6.7	8.15	30
5	22	6.8	8.37	30	22	6.8	8.37	30	22	6.7	8.30	30	22	6.7	8.35	30	22	6.7	8.33	30
6	22	6.9	8.31	30	22	7.1	8.32	30	22	7.1	8.31	30	22	6.5	8.18	30	22	6.9	8.28	30
7	22	7.0	8.18	30	22	7.1	8.29	30	22	7.1	8.28	30	22	6.9	8.25	29	22	6.9	8.25	30
8	21	7.1	8.06	28	21	7.0	7.32	28	21	7.3	8.30	29	21	7.2	8.32	30	21	7.1	8.34	30
9	21	6.3	8.41	28	21	6.2	8.42	30	21	6.3	8.42	29	21	6.1	8.44	29	21	6.3	8.42	30
10	21	6.3	8.48	29	21	6.1	8.46	29	21	6.0	8.48	29	21	6.2	8.47	29	21	6.1	8.47	30

CLIENT: SAIC  
 STUDY NUMBER: 7814  
 PROJECT: RAYMARK 1999  
 PARAMETER: Water Quality Data

**C-2-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.7	8.02	28	22	6.8	8.04	28	22	6.8	7.98	28	22	6.7	7.99	28	22	6.7	8.03	28
1	22	6.6	8.00	31	22	6.6	8.01	31	22	6.4	7.98	31	22	6.5	7.99	31	22	6.5	7.97	31
2	22	6.4	8.09	29	22	6.8	8.09	28	22	7.0	8.09	28	22	7.1	8.10	28	22	7.1	8.11	28
3	22	7.3	8.17	29	22	7.3	8.11	29	22	7.3	8.12	28	22	7.3	8.14	28	22	7.2	8.14	28
4	22	6.9	8.14	29	22	6.8	8.13	30	22	6.7	8.14	30	22	6.8	8.13	29	22	6.9	8.14	29
5	22	6.6	8.35	30	22	5.6	8.08	30	22	6.5	8.30	30	22	6.6	8.32	30	22	6.6	8.24	30
6	22	6.9	8.29	30	22	7.0	8.28	29	22	7.0	8.27	29	22	7.0	8.27	29	22	7.0	8.26	29
7	22	7.0	8.27	29	22	7.0	8.24	29	22	7.0	8.23	29	22	7.0	8.26	29	22	7.0	8.26	30
8	21	7.2	8.07	28	21	7.2	8.22	28	21	7.2	8.23	29	21	7.2	8.30	29	21	7.3	8.21	29
9	21	5.9	8.31	29	21	6.0	8.33	30	21	6.1	8.32	29	21	6.0	8.33	29	21	6.1	8.34	28
10	21	6.0	8.39	30	21	6.1	8.39	30	21	6.1	8.35	30	21	6.1	8.36	29	21	6.3	8.34	29

**C-3-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.7	8.00	28.3	22	6.8	8.01	28	22	6.8	7.97	28	22	6.8	7.98	28	22	6.9	7.66	28
1	22	6.5	7.95	29	22	6.6	7.96	31	22	6.6	7.97	31	22	6.7	7.95	31	22	6.4	7.95	31
2	22	7.0	8.10	28	22	7.1	8.03	29	22	7.1	7.97	28	22	7.1	7.97	29	22	7.0	7.99	29
3	22	7.2	8.09	29	22	7.2	8.02	28	22	7.3	8.01	28	22	7.3	7.99	28	22	7.1	7.99	28
4	22	6.7	8.07	30	22	6.6	8.05	29	22	6.4	8.15	29	22	6.5	8.19	29	22	6.6	8.16	30
5	22	6.7	8.07	29	22	6.7	7.92	30	22	6.7	7.98	30	22	6.7	8.02	30	22	6.8	8.01	30
6	22	6.9	8.10	29	22	6.9	7.97	29	22	6.9	7.87	29	22	7.0	7.93	29	22	7.1	7.93	30
7	22	6.8	7.94	29	22	6.9	7.80	28	22	6.9	7.79	28	22	7.0	7.79	28	22	7.0	7.82	28
8	21	7.2	7.16	29	21	7.7	7.68	28	21	7.1	7.71	29	21	7.2	7.84	29	21	7.1	7.85	29
9	21	5.9	8.15	29	21	5.9	8.01	29	21	5.7	7.91	30	21	6.0	7.90	30	21	5.8	7.95	30
10	21	5.8	8.16	29	21	6.1	8.03	29	21	5.5	8.01	30	21	5.6	8.01	30	21	5.9	8.03	29

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D-1-SED-SMP

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.1	7.66	30	22	6.1	7.90	30	22	6.6	7.92	30	22	6.8	7.86	30	22	6.8	7.83	30
1	22	5.9	7.92	33	22	6.0	7.90	33	22	6.2	7.95	33	22	6.6	7.94	33	22	6.5	7.91	33
2	22	6.9	7.98	29	22	7.0	7.97	28	22	7.0	7.94	30	22	7.0	7.93	30	22	7.0	7.88	29
3	22	7.1	7.97	29	22	7.2	7.87	29	22	7.3	7.86	29	22	7.1	7.87	28	22	7.2	7.83	29
4	22	6.7	8.06	29	22	7.0	7.93	29	22	6.9	7.91	30	22	6.6	7.96	29	22	6.8	7.97	29
5	22	6.7	7.95	30	22	6.8	7.91	30	22	6.8	7.90	30	22	6.8	7.81	30	22	6.8	7.80	30
6	22	6.9	7.89	29	22	7.0	7.80	28	22	7.1	7.79	29	22	7.1	7.80	29	22	7.1	7.77	28
7	22	7.0	7.70	29	22	7.0	7.70	28	22	7.1	7.71	29	22	7.0	7.70	29	22	7.0	7.59	29
8	21	7.3	7.54	29	21	7.3	7.71	29	21	7.3	7.70	29	21	7.3	7.61	30	21	7.3	7.75	31
9	21	6.2	7.88	28	21	6.3	7.86	29	21	6.4	7.82	29	21	6.2	7.79	29	21	6.2	7.82	30
10	21	6.0	7.87	29	21	6.0	7.89	29	21	6.3	7.88	29	21	6.3	7.81	29	21	6.2	7.83	30

D-2-SED-SMP

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.6	8.00	28	22	6.6	8.03	28	22	6.6	7.78	28	22	6.5	8.03	28	22	6.6	8.02	28
1	22	6.4	7.91	30	22	6.4	7.97	30	22	6.5	8.00	30	22	6.2	8.01	30	22	6.1	8.00	30
2	22	6.8	8.12	30	22	7.0	8.12	29	22	7.1	8.13	30	22	7.0	8.11	29	22	7.0	8.09	29
3	22	7.4	8.06	28	22	7.4	8.12	28	22	7.3	8.14	28	22	7.3	8.12	28	22	7.1	8.09	28
4	22	6.9	7.91	30	22	6.8	7.90	29	22	6.8	7.88	30	22	6.9	7.86	30	22	6.9	7.81	30
5	22	6.8	8.31	30	22	6.8	8.26	30	22	6.8	8.25	30	22	6.8	8.20	30	22	6.3	7.96	30
6	22	6.9	8.18	28	22	7.0	8.23	28	22	7.1	8.23	29	22	7.1	8.19	28	22	7.1	8.09	30
7	22	6.9	8.20	28	22	7.0	8.21	28	22	7.0	8.19	29	22	7.0	8.19	28	22	6.9	8.05	30
8	21	7.4	8.13	28	21	7.3	8.17	30	21	7.2	8.15	30	21	7.1	8.13	30	21	7.1	8.08	32
9	21	6.8	8.23	30	21	6.5	8.26	30	21	6.6	8.25	29	21	6.5	8.17	29	21	6.4	8.16	30
10	21	6.1	8.29	30	21	6.2	8.28	30	21	6.3	8.26	30	21	6.4	8.23	29	21	6.2	8.18	30



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D-3-SED-SMP

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.7	8.03	29	22	6.7	8.06	29	22	6.8	8.02	29	22	6.8	7.96	29	22	6.7	8.00	29
1	22	6.5	7.97	30	22	6.5	7.99	30	22	6.4	7.99	30	22	6.3	8.01	30	22	6.2	7.96	30
2	22	6.6	8.08	30	22	6.8	8.05	29	22	6.9	8.03	30	22	6.9	8.06	29	22	6.9	8.05	30
3	22	7.3	8.05	28	22	7.4	8.08	28	22	7.4	8.07	28	22	7.4	8.07	28	22	7.5	8.01	29
4	22	7.0	8.15	29	22	7.0	8.17	29	22	6.9	8.15	29	22	6.9	8.14	28	22	6.8	8.06	29
5	22	6.6	8.08	30	22	6.7	8.11	30	22	6.8	8.17	30	22	6.8	8.01	30	22	6.7	8.05	30
6	22	7.0	8.09	29	22	7.0	8.09	30	22	7.1	8.14	29	22	7.0	8.01	29	22	7.0	7.98	30
7	22	6.8	8.08	30	22	6.9	8.03	29	22	6.9	8.08	30	22	6.9	7.93	30	22	6.9	7.87	29
8	21	7.4	8.04	30	21	7.3	7.93	30	21	7.2	8.12	30	21	7.2	7.99	30	21	7.3	7.96	31
9	21	6.0	8.23	29	21	5.9	8.06	30	21	6.0	8.24	29	21	5.8	8.16	30	21	5.7	8.10	29
10	21	6.2	8.22	29	21	6.1	8.11	30	21	6.0	8.26	29	21	6.0	8.15	30	21	5.9	8.13	29

D-4-SED-SMP

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.6	8.04	29	22	6.6	8.01	29	22	6.6	7.98	29	22	6.6	7.97	29	22	6.5	7.97	29
1	22	6.1	8.05	30	22	6.5	8.07	30	22	5.9	8.07	30	22	6.3	8.05	30	22	6.1	8.08	30
2	22	6.5	8.25	30	22	6.7	8.25	29	22	6.8	8.24	29	22	6.8	8.23	29	22	6.9	8.23	30
3	22	7.3	8.30	28	22	7.3	8.31	28	22	7.4	8.31	28	22	7.5	8.31	27	22	7.4	8.31	29
4	22	6.9	8.33	30	22	6.4	8.34	31	22	6.6	8.34	30	22	6.8	8.35	30	22	6.8	8.37	30
5	22	6.7	8.44	30	22	6.7	8.43	30	22	6.6	8.40	30	22	6.6	8.43	30	22	6.6	8.48	30
6	22	6.8	8.42	30	22	6.8	8.41	29	22	6.9	8.40	30	22	7.0	8.40	28	22	7.0	8.43	30
7	22	6.7	8.36	29	22	6.8	8.37	28	22	6.8	8.35	29	22	6.8	8.40	28	22	6.8	8.41	30
8	21	7.3	8.33	30	21	7.3	8.35	30	21	7.3	8.34	30	21	7.3	8.43	30	21	7.2	8.45	31
9	21	6.0	8.42	29	21	6.2	8.48	29	21	6.1	8.48	30	21	6.2	8.53	30	21	6.0	8.54	30
10	21	5.6	8.44	29	21	5.8	8.50	29	21	6.0	8.47	29	21	6.0	8.54	30	21	6.1	8.54	30

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**D-5-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.5	7.85	29	22	6.5	7.96	29	22	6.6	7.87	29	22	6.6	7.88	29	22	6.5	7.97	29
1	22	6.2	8.02	30	22	6.1	7.98	30	22	6.4	7.99	30	22	6.3	8.00	30	22	6.3	7.98	30
2	22	6.6	8.17	29	22	6.7	8.16	29	22	6.8	8.09	27	22	6.8	8.09	30	22	6.8	8.08	30
3	22	7.3	8.18	28	22	7.4	8.17	29	22	7.4	8.18	28	22	7.3	8.15	28	22	7.3	8.09	29
4	22	6.8	8.31	29	22	6.8	8.27	29	22	6.8	8.25	29	22	6.6	8.21	28	22	6.4	8.15	29
5	22	6.5	8.36	30	22	6.5	8.29	30	22	6.6	8.31	30	22	6.6	8.29	30	22	6.6	8.36	30
6	22	6.7	8.31	29	22	6.9	8.23	30	22	7.0	8.24	29	22	7.0	8.25	29	22	6.9	8.23	30
7	22	6.8	8.22	29	22	6.8	8.15	29	22	6.9	8.15	29	22	6.8	8.17	28	22	6.8	8.15	30
8	21	7.4	8.09	29	21	7.3	8.11	31	21	7.4	8.12	30	21	7.3	8.11	33	21	7.2	8.14	31
9	21	6.0	8.39	28	21	6.0	8.25	29	21	5.8	8.24	29	21	6.0	8.21	30	21	6.2	8.20	31
10	21	5.8	8.30	28	21	5.9	8.27	28	21	6.0	8.26	28	21	6.0	8.22	29	21	6.1	8.21	29

**D-6-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.6	8.04	29	22	6.5	8.01	29	22	6.8	8.02	29	22	6.8	8.00	29	22	6.8	7.96	29
1	22	6.1	7.93	31	22	6.1	8.00	31	22	6.4	7.95	31	22	6.3	8.02	31	22	6.2	8.03	31
2	22	6.4	8.07	30	22	6.6	8.08	30	22	6.9	8.11	30	22	6.9	8.11	30	22	7.1	8.13	30
3	22	7.3	8.04	28	22	7.4	8.11	28	22	7.4	8.12	29	22	7.4	8.13	28	22	7.4	8.08	30
4	22	6.4	8.08	30	22	6.5	8.12	29	22	6.4	8.15	29	22	6.6	8.17	29	22	6.8	8.15	29
5	22	6.1	8.13	30	22	6.5	8.18	30	22	6.6	8.20	30	22	6.6	8.21	30	22	6.6	8.25	30
6	22	6.5	8.10	29	22	6.8	8.10	30	22	6.9	8.19	30	22	6.9	8.19	30	22	7.0	8.18	30
7	22	6.6	7.99	27	22	6.7	7.99	28	22	6.9	8.15	28	22	6.8	8.16	28	22	6.8	8.13	30
8	21	7.3	8.06	29	21	7.4	8.00	31	21	7.2	8.25	30	21	7.4	8.30	31	21	7.3	8.27	31
9	21	6.3	8.15	30	21	6.5	8.16	31	21	6.2	8.46	32	21	6.3	8.28	31	21	6.4	8.56	30
10	21	5.7	8.20	30	21	5.9	8.26	30	21	6.0	8.47	30	21	6.0	8.60	30	21	6.2	8.63	30

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D-6-SED-FD

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.7	8.04	28	22	6.7	8.00	28	22	6.8	8.03	28	22	6.8	7.99	28	22	6.8	7.96	28
1	22	6.4	7.98	29	22	6.3	7.98	29	22	6.4	8.02	29	22	6.4	8.04	29	22	6.4	8.04	29
2	22	6.5	7.97	29	22	6.7	7.98	29	22	7.0	8.02	30	22	6.9	8.05	30	22	7.1	8.05	30
3	22	7.2	8.06	26	22	7.4	8.04	28	22	7.4	8.03	28	22	7.4	8.03	28	22	7.5	8.02	29
4	22	7.0	7.94	30	22	7.2	7.99	29	22	6.8	7.98	30	22	6.8	7.99	30	22	6.5	7.92	29
5	22	6.4	7.89	30	22	6.8	8.00	30	22	6.9	8.02	30	22	6.8	8.02	30	22	6.9	8.01	30
6	22	6.8	7.93	28	22	6.8	8.00	28	22	6.9	8.00	29	22	7.0	8.00	28	22	7.0	7.95	29
7	22	6.7	7.96	28	22	6.8	7.86	28	22	6.9	7.86	29	22	7.0	7.92	30	22	6.9	7.92	30
8	21	7.1	7.73	30	21	7.3	7.90	28	21	7.3	7.92	30	21	7.4	7.92	30	21	7.4	7.88	31
9	21	5.8	8.13	29	21	6.0	8.08	29	21	6.1	8.06	30	21	6.0	8.05	29	21	6.2	8.04	30
10	21	6.1	8.11	29	21	5.8	8.04	29	21	6.0	8.06	30	21	6.1	8.05	29	21	6.2	8.06	29

E-1-SED-SMP

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.7	7.42	27	22	6.8	7.09	27	22	6.8	7.90	27	22	6.7	7.26	27	22	6.8	7.51	27
1	22	6.3	7.87	29	22	6.4	7.65	29	22	6.4	7.62	29	22	6.5	7.58	29	22	6.6	7.58	29
2	22	7.0	8.02	30	22	7.1	7.53	26	22	7.2	7.51	27	22	7.1	7.52	27	22	7.1	7.54	28
3	22	7.3	7.96	26	22	7.4	7.46	26	22	7.5	7.44	26	22	7.5	7.46	26	22	7.5	7.44	26
4	22	6.4	7.74	26	22	6.2	7.54	27	22	6.3	7.49	26	22	6.4	7.48	26	22	6.5	7.44	26
5	22	6.5	7.42	30	22	6.8	7.25	30	22	6.9	7.37	30	22	6.8	6.93	30	22	6.8	7.40	30
6	22	6.2	7.23	27	22	6.7	7.23	27	22	6.9	7.33	27	22	6.7	7.34	27	22	6.8	7.32	27
7	22	6.7	7.53	27	22	6.8	7.47	26	22	6.9	7.36	27	22	6.7	7.34	27	22	6.9	7.32	27
8	21	7.0	8.29	26	21	7.2	6.54	27	21	7.4	6.85	27	21	7.3	6.76	28	21	7.3	6.88	28
9	21	6.0	7.68	27	21	6.0	7.49	27	21	6.0	7.43	27	21	6.3	7.38	27	21	6.2	7.36	28
10	21	5.7	7.42	28	21	6.1	7.33	28	21	6.2	7.21	27	21	5.9	7.17	27	21	5.9	7.23	28

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**E-2-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	2.3	6.52	28	22	3.1	6.52	28	22	3.4	6.50	28	22	3.7	6.51	28	22	3.6	6.50	28
1	22	7.0	7.58	30	22	7.3	7.54	30	22	7.6	7.64	30	22	7.5	7.65	30	22	7.2	7.56	30
2	22	6.7	7.56	27	22	7.0	7.54	26	22	7.1	7.49	26	22	7.0	7.45	26	22	7.0	7.43	26
3	22	7.4	7.44	26	22	7.5	7.31	26	22	7.5	7.29	26	22	7.5	7.27	26	22	7.5	7.24	26
4	22	6.8	7.40	26	22	6.7	7.37	25	22	6.8	7.32	26	22	6.6	7.32	25	22	6.5	7.28	25
5	22	6.9	7.07	30	22	6.9	6.95	30	22	6.9	6.96	30	22	6.9	7.01	30	22	6.9	7.07	30
6	22	6.7	7.39	27	22	6.9	7.42	27	22	7.0	7.43	27	22	6.8	7.44	26	22	6.9	7.43	26
7	22	6.9	7.35	27	22	6.9	7.34	27	22	6.9	7.31	27	22	6.9	7.29	26	22	6.8	7.28	27
8	21	7.6	6.88	27	21	7.3	6.93	29	21	7.4	6.93	27	21	7.5	6.69	27	21	7.4	6.63	28
9	21	6.7	7.41	27	21	6.6	7.41	28	21	6.3	7.40	27	21	6.4	7.41	27	21	6.2	7.39	27
10	21	6.4	7.33	27	21	6.3	7.36	27	21	6.4	7.37	28	21	6.4	7.41	28	21	6.4	7.40	28

**E-3-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.4	7.47	27	22	6.5	7.53	27	22	6.7	7.40	27	22	6.8	7.41	27	22	6.7	7.37	27
1	22	6.4	7.55	29	22	6.3	7.57	29	22	6.5	7.57	29	22	7.0	7.56	29	22	6.8	7.51	29
2	22	6.9	7.44	27	22	7.1	7.47	27	22	7.1	7.50	28	22	7.1	7.51	28	22	7.1	7.50	28
3	22	7.6	7.21	26	22	7.5	7.46	26	22	7.5	7.47	26	22	7.3	7.47	26	22	7.4	7.45	26
4	22	6.6	7.28	25	22	6.4	7.30	26	22	6.5	7.31	26	22	6.5	7.24	26	22	6.5	7.22	25
5	22	6.9	7.26	30	22	6.9	7.25	30	22	6.9	7.29	30	22	6.9	6.96	30	22	6.7	6.99	30
6	22	7.0	7.56	28	22	7.0	7.56	28	22	7.1	7.57	27	22	6.9	7.56	27	22	6.9	7.48	28
7	22	6.7	7.27	30	22	6.9	7.46	28	22	7.0	7.46	27	22	6.9	7.27	26	22	6.8	7.56	27
8	21	7.5	7.25	28	21	7.4	7.23	29	21	7.4	7.19	28	21	7.4	6.94	28	21	7.3	7.15	30
9	21	5.8	7.35	29	21	5.9	7.34	28	21	5.7	7.35	29	21	5.8	7.35	28	21	5.9	7.28	29
10	21	5.9	7.33	29	21	6.1	7.31	29	21	6.1	7.38	29	21	6.1	7.37	28	21	6.0	7.29	29

CLIENT: SAIC  
 STUDY NUMBER: 7814  
 PROJECT: RAYMARK 1999  
 PARAMETER: Water Quality Data

**E-4-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.8	4.29	27	22	6.9	3.71	27	22	6.9	3.90	27	22	6.9	4.41	27	22	6.9	4.38	27
1	22	6.4	7.37	29	22	6.8	7.16	29	22	6.7	6.74	29	22	6.6	6.75	29	22	6.7	6.75	29
2	22	6.8	6.84	28	22	7.0	5.51	27	22	7.1	5.04	27	22	7.0	5.51	29	22	7.1	5.38	28
3	22	7.5	7.25	27	22	7.5	7.23	26	22	7.5	7.20	27	22	7.5	7.16	28	22	7.4	7.17	28
4	22	6.6	7.17	27	22	6.5	7.14	26	22	6.8	7.11	27	22	6.6	7.12	28	22	6.7	7.14	27
5	22	6.8	6.75	30	22	6.9	5.89	30	22	7.0	6.53	30	22	7.0	6.99	30	22	6.9	6.85	30
6	22	6.9	7.47	27	22	7.1	6.86	27	22	7.1	7.10	28	22	7.1	7.26	28	22	7.0	7.27	28
7	22	6.9	7.26	27	22	7.0	6.48	26	22	7.0	6.48	28	22	6.9	6.89	27	22	6.9	6.90	27
8	21	7.6	6.36	27	21	7.5	6.06	27	21	7.5	6.44	28	21	7.5	6.93	28	21	7.5	6.60	29
9	21	5.8	7.22	27	21	5.7	6.99	26	21	5.9	6.97	27	21	5.9	7.02	26	21	5.8	7.05	29
10	21	6.1	7.28	27	21	6.1	7.17	27	21	5.9	7.16	27	21	5.8	7.25	27	21	5.7	7.28	28

**F-1-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.9	7.99	29	22	6.9	8.00	29	22	6.9	7.95	29	22	6.9	8.00	29	22	6.8	7.90	29
1	22	7.1	7.74	31	22	6.9	7.91	31	22	6.8	7.98	31	22	7.0	8.04	31	22	6.9	8.04	31
2	22	6.8	7.78	30	22	7.0	8.03	30	22	7.0	8.05	30	22	7.0	8.06	29	22	7.1	8.07	29
3	22	7.3	8.14	28	22	7.4	8.16	29	22	7.5	8.17	29	22	7.4	8.17	29	22	7.4	8.16	29
4	22	6.8	8.14	28	22	6.7	8.29	28	22	6.7	8.32	28	22	6.8	8.27	28	22	6.6	8.26	28
5	22	6.8	8.43	30	22	6.8	8.58	30	22	6.7	8.51	30	22	6.8	8.44	30	22	6.8	8.42	30
6	22	6.9	8.43	29	22	7.0	8.58	29	22	7.0	8.58	29	22	7.0	8.47	30	22	6.9	8.46	29
7	22	6.8	8.46	29	22	6.9	8.49	29	22	6.9	8.48	29	22	6.9	8.47	30	22	6.9	8.46	29
8	21	7.5	8.40	29	21	7.5	8.33	30	21	7.5	8.36	30	21	7.5	8.38	31	21	7.5	8.48	30
9	21	5.9	8.45	29	21	6.1	8.44	30	21	6.3	8.44	29	21	5.9	8.45	30	21	6.0	8.52	30
10	21	6.1	8.33	29	21	6.1	8.33	29	21	6.1	8.38	29	21	6.3	8.38	29	21	6.2	8.45	30

CLIENT: SAIC  
 STUDY NUMBER: 7814  
 PROJECT: RAYMARK 1999  
 PARAMETER: Water Quality Data

**F-2-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.6	8.01	29	22	6.6	7.99	29	22	6.7	7.98	29	22	6.7	7.98	29	22	6.8	7.96	29
1	22	6.4	8.03	31	22	6.6	8.04	31	22	6.6	8.06	31	22	6.4	8.07	31	22	6.9	8.04	31
2	22	6.7	8.10	29	22	6.9	8.10	30	22	7.0	8.11	30	22	7.0	8.10	30	22	6.9	8.08	30
3	22	7.4	8.13	29	22	7.5	8.11	28	22	7.4	8.10	29	22	7.4	8.08	29	22	7.5	8.08	29
4	22	6.8	8.10	27	22	6.9	8.08	27	22	6.6	8.07	28	22	6.9	8.06	28	22	6.7	8.06	27
5	22	6.8	8.14	30	22	6.8	8.12	30	22	6.8	8.09	30	22	6.8	8.12	30	22	6.8	8.10	30
6	22	7.1	8.16	29	22	7.1	8.11	29	22	7.1	8.10	29	22	7.2	8.08	29	22	7.0	8.06	30
7	22	6.9	8.09	28	22	7.0	8.00	28	22	6.7	7.86	28	22	6.8	7.92	29	22	6.8	7.92	28
8	21	7.5	7.65	28	21	7.5	7.96	30	21	7.4	7.86	29	21	7.4	7.97	31	21	7.5	7.92	30
9	21	6.2	8.27	28	21	6.3	8.18	30	21	6.1	8.02	28	21	6.3	8.06	30	21	6.3	8.08	29
10	21	5.9	8.18	28	21	6.1	8.08	29	21	6.3	7.97	29	21	6.2	8.04	29	21	6.4	8.04	28

**F-3-SED-SMP**

Day	Replicate A				Replicate B				Replicate C				Replicate D				Replicate E			
	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal	Temp	D.O.	pH	Sal
0	22	6.6	8.04	28	22	6.5	8.00	28	22	6.5	8.08	28	22	6.5	8.03	28	22	6.5	8.08	28
1	22	6.5	8.06	30	22	6.6	8.07	30	22	6.3	8.10	30	22	6.2	8.08	30	22	6.3	8.10	30
2	22	6.6	8.11	29	22	6.8	8.16	30	22	7.0	8.18	30	22	7.0	8.17	30	22	7.0	8.15	29
3	22	7.3	8.08	28	22	7.4	8.12	28	22	7.5	8.14	28	22	7.4	8.15	28	22	7.4	8.15	28
4	22	6.6	8.11	29	22	6.8	8.12	30	22	6.6	8.12	29	22	6.6	8.12	28	22	6.8	8.13	28
5	22	6.8	8.18	30	22	6.7	8.18	30	22	6.8	8.18	30	22	6.9	8.17	30	22	6.8	8.17	30
6	22	7.1	8.18	29	22	7.1	8.18	29	22	7.1	8.17	29	22	7.1	8.16	28	22	7.1	8.16	28
7	22	6.8	8.15	27	22	7.0	8.14	28	22	7.0	8.13	28	22	6.9	8.12	28	22	6.9	8.09	28
8	21	7.4	7.99	29	21	7.4	8.19	29	21	7.4	8.18	29	21	7.5	8.09	29	21	7.5	8.09	29
9	21	6.1	8.34	28	21	6.3	8.42	28	21	6.2	8.41	29	21	6.3	8.26	29	21	6.1	8.21	29
10	21	5.9	8.33	28	21	6.1	8.29	28	21	6.3	8.31	29	21	6.3	8.31	29	21	6.3	8.16	28

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7314		SAMPLE ID: Control				DILUENT: Hampton Estuary				START DATE:			
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	
0	22	6.6	7.93	30	22	6.8	7.94	30	22	6.9	7.96	30	JR
1	22	6.4	7.77	32	22	6.7	7.92	32	22	6.8	7.86	32	WL
2	22	7.2	7.72	29	22	7.2	7.94	30	22	7.1	7.98	30	—
3	22	7.5	7.98	29	22	7.5	7.98	28	22	7.6	7.97	29	—
4	22	7.0	7.87	31	22	6.8	7.89	31	22	6.8	7.90	30	WL
5	22	7.0	8.07	30	22	6.9	8.00	30	22	6.8	7.99	30	KOB
6	22	7.1	7.98	30	22	7.1	7.97	30	22	7.1	7.96	30	—
7	22	7.1	7.87	30	22	7.1	7.86	30	22	7.1	7.86	30	—
8	21	7.2	7.90	29	21	7.2	6.92	29	21	7.2	6.87	28	CV
9	21	6.9	8.03	30	21	6.9	8.14	30	21	6.1	8.06	29	WL
10	21	6.5	8.10	30	21	6.4	8.19	30	21	6.4	8.17	30	CF
# ALIVE	18				20				10 <sup>2</sup> 18				14

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	A	B	C	D	E
0	22	6.9	7.95	30	22	6.9	7.95	30	✓	///	///	///	///
1	22	6.8	7.86	32	22	6.8	7.77	32					
2	22	7.0	7.98	30	22	6.9	7.95	30					
3	22	7.5	7.94	28	22	7.6	7.95	29					
4	22	6.8	7.83	31	22	6.7	7.88	31					
5	22	6.7	8.03	30	22	6.8	8.09	30	KOB	///	///	///	///
6	22	7.1	7.95	30	22	7.1	7.96	30					
7	22	7.1	7.86	30	22	7.1	7.91	30					
8	21	7.2	7.08	29	21	7.1	7.96	31					
9	21	6.1	8.07	28	21	6.3	8.07	29					
10	21	6.4	8.17	30	21	6.3	8.14	30	CF	///	///	///	///
# ALIVE	16				10								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

***Ampelisca abdita* CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814-1					SAMPLE ID: C-1-SED-SMP				DILUENT: Hampton Estuary		START DATE:		
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	
0	22	6.8	8.01	29	22	6.8	8.01	29	22	6.8	7.99	29	2
1	22	6.6	7.99	31	22	6.4	8.01	31	22	6.4	8.01	31	UL
2	22	6.8	8.00	30	22	7.0	8.10	29	22	6.9	8.10	29	—
3	22	7.4	8.12	29	22	7.4	8.12	27	22	7.4	8.12	27	—
4	22	6.8	8.12	31	22	6.9	8.16	31	22	6.6	8.15	30	UL
5	22	6.8	8.37	30	22	6.8	8.37	30	22	6.7	8.30	30	XAB
6	22	6.9	8.31	30	22	7.1	8.32	30	22	7.1	8.31	30	—
7	22	7.0	8.18	30	22	7.1	8.29	30	22	7.1	8.28	30	—
8	21	7.1	8.06	28	21	7.0	8.32	28	21	7.3	8.30	27	—
9	21	6.3	8.41	28	21	6.2	8.42	30	21	6.3	8.42	29	UL
10	21	6.3	8.45	29	21	6.1	8.46	29	21	6.0	8.45	29	CA
# ALIVE	13				13				9				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	A	B	C	D	E
0	22	6.7	8.00	29	22	6.7	8.02	29	8	14	11	11	11
1	22	6.4	8.11	31	22	6.3	8.01	31					
2	22	6.9	8.10	28	22	6.9	8.09	28					
3	22	7.3	8.11	27	22	7.4	8.10	27					
4	22	6.8	8.4	31	22	6.7	8.15	30					
5	22	6.7	8.35	30	22	6.7	8.33	30	XAB				
6	22	6.5	8.18	30	22	6.9	8.28	30					
7	22	6.9	8.25	29	22	6.9	8.25	30					
8	21	7.2	8.32	30	21	7.1	8.34	30					
9	21	6.1	8.44	29	21	6.3	8.42	30					
10	21	6.2	8.47	29	21	6.1	8.47	30	CA				
# ALIVE	5				9								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.



***Ampelisca abdita* CHRONIC EXPOSURE SEDIMENT ASSAY**

Amipensta abuta CHRONIC EXPOSURE SEDIMENT ASSAY														
STUDY # 7814-2				SAMPLE ID: C-2-SED-SMP				DILUENT: Hampton Estuary				START DATE:		
DAY	REP A				REP B				REP C				INITIALS	
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.		
0	22	6.7	8.02	28	22	6.8	8.04	28	22	6.8	7.98	28	R	
1	22	1.6	8.00	31	22	1.6	8.01	31	22	1.4	7.98	31	W	
2	22	6.4	8.09	29	22	6.8	8.09	28	22	7.0	8.09	28	—	
3	22	7.3	8.17	29	22	7.3	8.11	29	22	7.3	8.12	28	—	
4	22	6.9	8.14	29	22	1.8	8.13	30	22	6.7	8.14	30	W	
5	22	6.6	8.35	30	22	5.6	8.08	30	22	6.5	8.30	30	XNB	
6	22	6.9	8.29	30	22	7.0	8.28	29	22	7.0	8.27	29	—	
7	22	7.0	8.27	29	22	7.0	8.24	29	22	7.0	8.23	29	—	
8	21	7.2	8.07	28	21	7.2	8.22	28	21	7.2	8.23	29		
9	21	5.9	8.31	29	21	6.0	8.33	30	21	6.1	8.32	29	W	
10	21	6.0	8.39	30	21	6.1	8.39	30	21	6.1	8.35	30	C	
# ALIVE	14				12				15					

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	A	B	C	D	E
0	22	6.7	7.99	28	22	6.7	8.03	28	8	W	W	W	W
1	22	1.5	7.99	31	22	1.5	7.97	31					
2	22	7.1	8.10	28	22	7.1	8.11	28					
3	22	7.3	8.14	28	22	7.2	8.14	28					
4	22	6.8	8.13	29	22	6.9	8.14	29					
5	22	6.6	8.32	30	22	6.6	8.24	30	XNB				
6	22	7.0	8.27	29	22	7.0	8.26	29					
7	22	7.0	8.26	29	22	7.0	8.26	30					
8	21	7.2	8.30	27	21	7.3	8.21	27					
9	21	4.0	8.33	29	21	6.1	8.34	28					
10	21	6.1	8.36	29	21	6.3	8.34	29	C				
# ALIVE	3				5								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814-3		SAMPLE ID: C-3-SED-SMP				DILUENT: Hampton Estuary				START DATE:			
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	
0	22	6.7	8.00	28	22	6.8	8.01	28	22	6.8	7.97	28	R
1	22	6.5	7.95	31	22	6.6	7.96	31	22	6.6	7.97	31	
2	22	7.0	8.10	29	22	7.1	8.03	29	22	7.1	7.97	28	—
3	22	7.2	8.09	28	22	7.2	8.02	28	22	7.3	8.01	28	~
4	22	6.7	8.07	29	22	6.6	8.05	29	22	6.4	8.15	29	W
5	22	6.7	8.07	30	22	6.7	7.92	30	22	6.7	7.98	30	WMS
6	22	6.9	8.10	29	22	6.9	7.87	29	22	6.9	7.87	29	—
7	22	6.8	7.94	29	22	6.9	7.80	28	22	6.9	7.79	28	—
8	21	7.2	7.16	21	21	7.7	7.68	28	21	7.1	7.71	29	FW
9	21	5.9	8.15	29	21	5.9	8.01	29	21	5.7	7.91	30	W
10	21	5.8	8.16	29	21	6.1	8.03	29	21	5.5	8.01	30	CL
# ALIVE	1				3				2				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	A	B	C	D	E
0	22	6.8	7.98	28	22	6.9	7.66	28	✓	///	///	///	///
1	22	6.7	7.95	31	22	6.4	7.95	31					
2	22	7.1	7.97	29	22	7.0	7.99	29					
3	22	7.3	7.99	28	22	7.1	7.99	28					
4	22	6.5	8.19	29	22	6.6	8.16	30					
5	22	6.7	8.02	30	22	6.8	8.01	30	WMS				
6	22	7.0	7.93	29	22	7.1	7.93	30					
7	22	7.0	7.79	28	22	7.0	7.82	28					
8	21	7.2	7.84	29	21	7.1	7.85	27					
9	21	6.0	7.90	30	21	5.8	7.95	30					
10	21	5.6	8.01	30	21	5.9	8.03	29	W				
# ALIVE	0				0								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814-4					SAMPLE ID: D-1-SED-SMP				DILUENT: Hampton Estuary		START DATE:		
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	22	6.1	7.66	30	22	6.1	7.90	30	22	6.6	7.92	30	22
1	22	5.9	7.92	33	22	6.0	7.90	33	22	6.2	7.95	33	111
2	22	6.9	7.98	29	22	7.0	7.97	28	22	7.0	7.94	30	—
3	22	7.1	7.97	29	22	7.2	7.87	29	22	7.3	7.86	29	~
4	22	6.7	8.06	29	22	7.0	7.93	29	22	6.9	7.91	30	111
5	22	6.7	7.95	30	22	6.8	7.91	30	22	6.8	7.90	30	2/100
6	22	6.9	7.89	29	22	7.0	7.80	28	22	7.1	7.79	29	—
7	22	7.0	7.70	29	22	7.0	7.70	28	22	7.1	7.71	29	—
8	21	7.3	7.59	29	21	7.3	7.71	29	21	7.3	7.70	27	CH
9	21	6.2	7.88	28	21	6.3	7.80	29	21	6.4	7.87	29	111
10	21	6.0	7.81	29	21	6.0	7.89	29	21	6.3	7.80	29	CH
# ALIVE	17				19				17				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	22	6.8	7.86	30	22	6.8	7.83	30	22	111	111	111	111
1	22	6.6	7.94	33	22	6.5	7.91	33					
2	22	7.0	7.93	30	22	7.0	7.88	29					
3	22	7.1	7.87	28	22	7.2	7.83	29					
4	22	6.6	7.96	29	22	6.8	7.97	29					
5	22	6.8	7.81	30	22	6.8	7.80	30	2/100				
6	22	7.1	7.80	29	22	7.1	7.77	28					
7	22	7.0	7.70	29	22	7.0	7.59	29					
8	21	7.3	7.61	30	21	7.3	7.79	31					
9	21	6.2	7.79	29	21	6.2	7.82	30					
10	21	6.3	7.84	29	21	6.2	7.89	30	CH				
# ALIVE	9				12								

- Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814-5					SAMPLE ID:				DILUENT: Hampton Estuary		START DATE:		
					D-2-SED-SMP								
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	22	6.6	8.00	28	22	6.6	8.03	28	22	6.6	7.78	28	X
1	22	6.4	7.91	30	22	6.4	7.97	30	22	6.5	8.00	30	ul
2	22	6.8	8.12	30	22	7.0	8.12	29	22	7.1	8.13	30	—
3	22	7.4	8.06	28	22	7.4	8.12	28	22	7.3	8.14	28	—
4	22	6.9	7.91	30	22	6.8	7.90	29	22	6.8	7.88	30	ul
5	22	6.8	8.31	30	22	6.8	8.26	30	22	6.8	8.25	30	XAS
6	22	6.9	8.18	28	22	7.0	8.23	28	22	7.1	8.23	29	—
7	22	6.9	8.20	28	22	7.0	8.21	28	22	7.0	8.19	29	—
8	21	7.4	8.13	28	21	7.3	8.17	30	21	7.2	8.15	30	CW
9	21	6.8	8.23	30	21	6.5	8.26	30	21	6.6	8.25	29	ul
10	21	6.1	8.29	30	21	6.8	8.28	30	21	6.9	8.26	30	Cd
# ALIVE	15				16				14				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	22	6.5	8.03	28	22	6.6	8.02	28	X	///	///	///	27
1	22	6.2	8.01	30	22	6.1	8.00	30					
2	22	7.0	8.11	29	22	7.0	8.09	29					
3	22	7.3	8.12	28	22	7.1	8.09	28					
4	22	6.9	7.86	30	22	6.9	7.81	30					
5	22	6.8	8.20	30	22	6.3	7.96	30	XAS				
6	22	7.1	8.19	28	22	7.1	8.09	30					
7	22	7.0	8.19	28	22	6.9	8.05	30					
8	21	7.1	8.13	30	21	7.1	8.08	32					
9	21	6.5	8.17	29	21	6.4	8.16	30					
10	21	6.4	8.23	29	21	6.2	8.18	30	Cd				
# ALIVE	5				5								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

***Ampelisca abdita* CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814 - 6					SAMPLE ID: D3-SED-SMP				DILUENT: Hampton Estuary		START DATE:		
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	22	6.7	8.03	29	22	6.7	8.06	29	22	6.8	8.02	29	✓
1	22	6.5	7.97	30	22	6.5	7.99	30	22	6.4	7.99	30	UL
2	22	6.6	8.08	30	22	6.8	8.05	29	22	6.9	8.03	30	—
3	22	7.3	8.05	28	22	7.4	8.08	28	22	7.4	8.07	28	—
4	22	7.0	8.15	29	22	7.0	8.17	29	22	6.9	8.15	29	UL
5	22	6.6	8.08	30	22	6.7	8.11	30	22	6.8	8.17	30	XAS
6	22	7.0	8.09	29	22	7.0	8.09	30	22	7.1	8.14	29	—
7	22	6.8	8.08	30	22	6.9	8.03	29	22	6.9	8.08	30	—
8	21	7.4	8.09	30	21	7.3	7.93	30	21	7.2	8.12	30	cn
9	21	6.0	8.23	29	21	5.9	8.06	30	21	6.0	8.24	29	UL
10	21	6.0	8.22	29	21	6.1	8.11	30	21	6.0	8.26	29	Cf
# ALIVE	10				12				10				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	22	6.8	7.96	29	22	6.7	8.00	29	✓	✓	✓	✓	✓
1	22	6.3	8.01	30	22	6.2	7.96	30					
2	22	6.9	8.06	29	22	6.9	8.05	30					
3	22	7.4	8.07	28	22	7.5	8.01	29					
4	22	6.9	8.14	28	22	6.8	8.06	29					
5	22	6.8	8.01	30	22	6.7	8.05	30	XAS				
6	22	7.0	8.01	29	22	7.0	7.88	30					
7	22	6.9	7.93	30	22	6.9	7.87	29					
8	21	7.2	7.97	30	21	7.3	7.96	31					
9	21	5.8	8.16	30	21	5.7	8.10	29					
10	21	6.0	8.15	30	21	5.9	8.13	29	✓				
# ALIVE	7				7								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814 - 2				SAMPLE ID: DH. SED-SMP				DILUENT: Hampton Estuary		START DATE:			
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	
0	22	6.6	8.04	29	22	6.6	8.01	29	22	6.6	7.98	29	X
1	22	6.1	8.35	30	22	6.5	8.37	30	22	5.9	8.07	30	111
2	22	6.5	8.25	30	22	6.7	8.25	29	22	6.8	8.24	29	
3	22	7.3	8.30	28	22	7.3	8.31	28	22	7.4	8.31	28	—
4	22	6.9	8.33	30	22	6.4	8.24	31	22	6.6	8.31	30	Wh
5	22	6.7	8.44	30	22	6.7	8.43	30	22	6.6	8.40	30	XAB
6	22	6.8	8.42	30	22	6.8	8.41	29	22	6.9	8.40	30	—
7	22	6.7	8.36	29	22	6.8	8.37	28	22	6.8	8.35	29	—
8	21	7.3	8.33	30	21	7.3	8.35	30	21	7.3	8.39	30	Cv
9	21	6.0	8.42	29	21	6.2	8.48	29	21	6.1	8.48	30	Wh
10	21	5.6	8.44	29	21	5.8	8.50	29	21	6.0	8.47	29	Cl
# ALIVE	14				16				12				115

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL.	TEMP	D.O.	pH	SAL.	A	B	C	D	E
0	22	6.6	7.97	29	22	6.5	7.97	29	X	111	11	22	111
1	22	6.3	8.35	31	22	6.1	8.38	30					
2	22	6.8	8.23	29	22	6.9	8.23	30					
3	22	7.5	8.31	27	22	7.4	8.31	29					
4	22	6.8	8.35	30	22	6.8	8.37	30					
5	22	6.6	8.43	30	22	6.6	8.48	30	XAB				
6	22	7.0	8.40	28	22	7.0	8.43	30					
7	22	6.8	8.40	28	22	6.8	8.41	30					
8	21	7.3	8.48	30	21	7.2	8.49	31					
9	21	6.2	8.53	30	21	6.0	8.54	30					
10	21	6.0	8.54	30	21	6.1	8.54	30	Cl				
# ALIVE	11				4								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

# *Ampeisca addita* CHRONIC EXPOSURE SEDIMENT ASSAY

STUDY #7814-8					SAMPLE ID: D-5-SED-SMP				DILUENT: Hampton Estuary		START DATE:		
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	22	6.5	7.85	29	22	6.5	7.96	29	22	6.6	7.87	29	JC
1	22	6.2	8.02	30	22	6.4	7.98	31	22	6.4	7.77	30	UL
2	22	6.6	8.17	29	22	6.7	8.16	29	22	6.8	8.09	27	—
3	22	7.3	8.18	28	22	7.4	8.17	29	22	7.4	8.18	28	—
4	22	6.8	8.31	29	22	6.8	8.27	29	22	6.8	8.25	29	UL
5	22	6.5	8.36	30	22	6.5	8.29	30	22	6.6	8.31	30	XTBS
6	22	6.7	8.31	29	22	6.9	8.23	30	22	7.0	8.24	29	—
7	22	6.8	8.22	29	22	6.8	8.15	29	22	6.9	8.15	29	—
8	21	7.4	8.09	29	21	7.3	8.11	31	21	7.4	8.12	30	CA
9	21	6.0	8.39	28	21	6.0	8.25	29	21	5.8	8.24	29	UL
10	21	5.8	8.30	28	21	5.9	8.27	28	21	6.0	8.26	28	CA
# ALIVE	12				17				10				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	22	6.6	7.88	29	22	6.5	7.97	29	2	111	111	111	111
1	22	6.3	8.00	30	22	6.3	7.98	30					
2	22	6.8	8.09	30	22	6.8	8.08	30					
3	22	7.3	8.15	28	22	7.3	8.09	29					
4	22	6.6	8.21	28	22	6.4	8.15	29					
5	22	6.6	8.29	30	22	6.6	8.36	30	XTBS				
6	22	7.0	8.25	29	22	6.9	8.23	30					
7	22	6.8	8.17	28	22	6.8	8.15	30					
8	21	7.3	8.11	33	21	7.2	8.14	31					
9	21	6.0	8.21	30	21	6.2	8.20	31					
10	21	6.0	8.22	29	21	6.1	8.21	29	CA				
# ALIVE	12				18								

- \* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

# Ammonia and CHRONIC EXPOSURE SEDIMENT ASSAY

STUDY #7814-9					SAMPLE ID:				DILUENT: Hampton Estuary		START DATE:		
D-6-SED-SMP													
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	21	6.6	8.04	29	21	6.5	8.01	29	21	6.8	8.02	29	X
1	22	6.1	7.93	31	22	6.1	8.10	31	22	6.4	7.95	31	UL
2	22	6.4	8.07	30	22	6.6	8.08	30	22	6.9	8.11	30	-
3	22	7.3	8.04	28	22	7.4	8.11	28	22	7.4	8.12	29	-
4	22	6.4	8.08	30	22	6.5	8.12	29	22	6.4	8.15	29	UL
5	22	6.1	8.13	30	22	6.5	8.18	30	22	6.6	8.26	30	XRS
6	22	6.5	8.10	29	22	6.8	8.10	30	22	6.9	8.19	30	-
7	22	6.6	7.99	27	22	6.7	7.99	28	22	6.9	8.15	28	-
8	21	7.3	8.06	29	21	7.4	8.00	31	21	7.2	8.25	30	CA
9	21	5.5	8.15	30	21	6.5	8.16	31	21	6.2	8.46	32	UL
10	21	5.7	8.20	30	21	5.9	8.26	30	21	6.0	8.47	30	CA
# ALIVE	0				5				0				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	22	6.8	8.00	29	21	6.8	7.96	29	X	///	///	///	///
1	22	6.3	8.02	31	22	6.2	8.03	31					
2	22	6.9	8.11	30	22	7.1	8.13	30					
3	22	7.4	8.13	28	22	7.4	8.08	30					
4	22	6.6	8.17	29	22	7.8	8.15	29					
5	22	6.6	8.21	30	22	6.6	8.25	30	XRS				
6	22	6.9	8.19	30	22	7.0	8.18	30					
7	22	6.8	8.16	28	22	6.8	8.13	30					
8	21	7.4	8.30	31	21	7.3	8.27	71					
9	21	6.3	8.07	31	21	6.4	8.56	30					
10	21	6.0	8.60	30	21	6.8	8.63	30	CA				
# ALIVE	0				0								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.



# *Amipensca abdita* CHRONIC EXPOSURE SEDIMENT ASSAY

Ampeisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY														
STUDY # 7814-10					SAMPLE ID: 56-SED-FD				DILUENT: Hampton Estuary				START DATE:	
DAY	REPA				REP B				REP C				INITIALS	
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL		
0	21	6.7	8.04	28	21	6.7	8.00	28	21	6.8	8.03	28	X	
1	22	6.4	7.98	29	22	6.3	7.98	29	22	6.4	8.02	29	del	
2	22	6.5	7.97	29	22	6.7	7.98	29	22	7.0	8.02	30		
3	22	7.2	8.06	26	22	7.4	8.04	28	22	7.4	8.03	28	~	
4	22	7.0	7.94	30	22	7.2	7.99	29	22	6.8	7.98	30	W	
5	22	6.4	7.89	30	22	6.8	8.00	30	22	6.9	8.02	30	7.68	
6	22	6.8	7.93	28	22	6.8	8.00	28	22	6.9	8.00	29	-	
7	22	6.7	7.96	28	22	6.8	7.86	28	22	6.9	7.86	29	-	
8	21	7.1	7.73	30	21	7.3	7.70	28	21	7.3	7.92	30		
9	21	5.8	8.13	29	21	6.0	8.15	29	21	6.1	8.06	30	W	
10	21	6.1	8.11	29	21	5.8	8.04	29	21	6.0	8.06	30	0	
# ALIVE	0				0				0					

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	6.8	7.99	28	22	6.8	7.96	28	X	//	//	//	//
1	22	6.4	8.04	29	22	6.4	8.04	29					
2	22	6.9	8.05	30	22	7.1	8.05	30					
3	22	7.4	8.03	28	22	7.5	8.02	29					
4	22	6.8	7.99	30	22	6.5	7.92	29					
5	22	6.8	8.02	30	22	6.9	8.01	30	X	//	//	//	//
6	22	7.0	8.00	28	22	7.0	7.95	29					
7	22	7.0	7.92	30	22	6.9	7.92	30					
8	21	7.4	7.92	30	21	7.4	7.88	31					
9	21	6.0	8.05	29	21	6.2	8.04	30					
10	21	6.1	8.05	29	21	6.2	8.06	29	CA				
# ALIVE	0				0								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814 - 11					SAMPLE ID: E-1-SED-SMP				DILUENT: Hampton Estuary		START DATE:		
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	21	6.7	7.42	27	21	6.8	7.09	27	21	6.8	7.29	27	ℓ
1	22	6.3	7.87	27	22	6.4	7.65	29	22	6.4	7.62	29	il
2	22	7.0	8.02	30	22	7.1	7.53	26	22	7.2	7.51	27	—
3	22	7.3	7.96	26	22	7.4	7.46	26	22	7.5	7.44	26	—
4	22	6.4	7.74	26	22	6.2	7.57	27	22	6.3	7.49	26	il
5	22	6.5	7.42	30	22	6.8	7.25	30	22	6.9	7.37	30	XPS
6	22	6.2	7.23	27	22	6.7	7.23	27	22	6.9	7.33	27	—
7	22	6.7	7.53	27	22	6.8	7.47	26	22	6.9	7.36	27	—
8	21	7.0	6.29	26	21	7.2	6.54	27	21	7.9	6.85	27	
9	21	6.0	7.68	27	21	6.0	7.49	27	21	6.0	7.43	27	il
10	21	5.7	7.42	28	21	6.1	7.33	28	21	6.2	7.81	27	ℓ
# ALIVE	11				14				15				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	6.7	7.26	27	21	6.8	7.51	27	ℓ	//	//	//	//
1	22	6.5	7.58	27	22	6.6	7.58	29					
2	22	7.1	7.52	27	22	7.1	7.54	28					
3	22	7.5	7.46	26	22	7.5	7.44	26					
4	22	6.4	7.48	26	22	6.5	7.41	26					
5	22	6.8	7.6.93	30	22	6.8	7.40	30	XPS	//	//	//	//
6	22	6.7	7.34	27	22	6.8	7.32	27					
7	22	6.7	7.34	27	22	6.9	7.32	27					
8	21	7.3	6.76	28	21	7.3	6.88	28					
9	21	6.3	7.38	27	21	6.2	7.36	28					
10	21	5.9	7.17	27	21	5.9	7.03	28	ℓ				
# ALIVE	9				14								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

~~XX See memo on 1/22/11~~

***Ampelisca abdita* CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814 -12					SAMPLE ID: E-2-SFD-SMP					DILUENT: Hampton Estuary					START DATE:				
DAY	REP A				REP B				REP C				INITIALS						
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL							
0	21	2.3	6.52	28	21	3.1	6.52	28	21	3.4	6.50	28	X						
1	22	7.0	7.58	31	22	7.3	7.54	31	22	7.6	7.54	31							
2	22	6.7	7.56	27	22	7.0	7.54	26	22	7.1	7.49	26	-						
3	22	7.4	7.44	26	22	7.5	7.31	26	22	7.5	7.29	26	-						
4	22	6.8	7.40	26	22	6.7	7.37	25	22	6.8	7.32	26	ick						
5	22	6.9	7.07	30	22	6.9	6.95	30	22	6.9	6.96	30	XHD						
6	22	6.7	7.39	27	22	6.9	7.42	27	22	7.0	7.43	27	-						
7	22	6.9	7.35	27	22	6.9	7.34	27	22	6.9	7.31	27	-						
8	21	7.6	6.88	27	21	7.3	6.93	27	21	7.4	6.93	27	cu						
9	21	6.4	7.41	27	21	6.6	7.41	28	21	6.3	7.41	27	ick						
10	21	6.4	7.33	27	21	6.3	7.36	27	21	6.4	7.37	28	ick						
# ALIVE	12				16				11				24						

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	3.7	6.51	28	21	3.6	6.50	28	X	/	/	/	/
1	22	7.5	7.65	31	22	7.2	7.56	31					
2	22	7.0	7.45	26	22	7.0	7.43	26					
3	22	7.5	7.27	26	22	7.5	7.24	26					
4	22	6.6	7.32	25	22	6.5	7.28	25					
5	22	6.9	7.01	30	22	6.9	7.07	30	X				
6	22	6.8	7.44	26	22	6.9	7.43	26					
7	22	6.9	7.29	26	22	6.8	7.23	27					
8	21	7.5	6.69	27	21	7.4	6.63	28					
9	21	6.4	7.41	27	21	6.2	7.39	27					
10	21	6.4	7.41	28	21	6.4	7.40	28	X				
# ALIVE	11				8								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

X X see min. 600 4/28/92

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814 -13					SAMPLE ID: E-3-SED-SMP				DILUENT: Hampton Estuary		START DATE:		
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	21	6.4	7.47	27	21	6.5	7.53	27	21	6.7	7.40	27	JK
1	22	6.4	7.55	27	22	6.5	7.57	27	22	6.5	7.57	27	JK
2	22	6.9	7.44	27	22	7.1	7.47	27	22	7.1	7.50	28	—
3	22	7.6	7.21	26	22	7.5	7.46	26	22	7.5	7.47	26	—
4	22	6.6	7.28	25	22	6.4	7.27	26	22	6.5	7.31	26	JK
5	22	6.9	7.26	30	22	6.9	7.25	30	22	6.9	7.29	30	XAS
6	22	7.0	7.56	28	22	7.0	7.56	28	22	7.1	7.57	27	—
7	22	6.7	7.27	30	22	6.9	7.46	28	22	7.0	7.46	27	—
8	21	7.5	7.24	28	21	7.4	7.23	29	21	7.4	7.17	28	JK
9	21	5.8	7.35	29	21	5.9	7.34	28	21	5.7	7.35	29	JK
10	21	5.9	7.33	29	21	6.1	7.31	29	21	6.1	7.38	29	JK
# ALIVE	16				19				11				JK

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	6.8	7.41	27	21	6.7	7.37	27	8	1	1	1	1
1	22	7.0	7.56	27	22	6.8	7.51	27					
2	22	7.1	7.57	28	22	7.1	7.50	28					
3	22	7.3	7.47	26	22	7.4	7.45	26					
4	22	6.5	7.21	26	22	6.5	7.22	25					
5	22	6.9	7.96	30	22	6.7	6.99	30	XAS				
6	22	6.9	7.56	27	22	6.9	7.48	28					
7	22	6.9	7.27	26	22	6.8	7.26	27					
8	21	7.4	6.99	28	21	7.3	7.15	30					
9	21	5.8	7.35	28	21	5.9	7.28	29					
10	21	6.1	7.57	28	21	6.0	7.29	29	JK				
# ALIVE	14				8								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

\* \* see m.s. Vol. 97-2

***Ampelisca abdita* CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY # 7814-14		SAMPLE ID: E4 SED SMP				DILUENT: Hampton Estuary				START DATE:			
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	21	6.8	4.35*	27	21	6.9	3.71*	27	21	6.9	3.70*	27	X
1	22	6.8	7.37	29	22	6.8	7.16	29	22	6.7	6.74	29	W
2	22	6.8	6.84*	28	22	7.0	5.51*	27	22	7.1	5.04*	27	—
3	22	7.5	7.25	27	22	7.5	7.23	26	22	7.5	7.20	27	—
4	22	6.6	7.17	27	22	6.5	7.14	26	22	6.8	7.11	27	W
5	22	6.8	6.75	30	22	6.9	5.89	30	22	7.0	6.55*	30	XHS
6	22	6.9	7.47	27	22	7.1	6.26	27	22	7.1	7.10	28	—
7	22	6.9	7.26	27	22	7.0	6.48	26	22	7.0	6.48	28	—
8	21	7.6	6.36	27	21	7.5	6.06	27	21	7.5	6.49	28	Ch
9	21	5.8	7.22	27	21	5.7	1.89	26	21	5.9	7.97	27	W
10	21	6.1	7.28	27	21	6.1	7.17	27	21	5.9	7.16	27	Ch
# ALIVE	8				10				13				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	6.9	4.41*	27	21	6.9	4.38*	27	XL	1/1	1/1	1/1	1/1
1	22	6.6	6.75	29	22	6.7	6.75	29					
2	22	7.0	5.51*	29	22	7.1	5.38*	28					
3	22	7.5	7.16	28	22	7.4	7.17	28					
4	22	6.6	7.12	28	22	6.7	7.14	27					
5	22	7.0	6.99	30	22	6.9	6.85	30	XHS				
6	22	7.1	7.26	28	22	7.0	7.27	28					
7	22	6.9	6.27	27	22	6.9	6.90	27					
8	21	7.5	6.95	28	21	7.5	6.60	29					
9	21	5.9	7.02	26	21	5.8	7.05	29					
10	21	5.8	7.05	27	21	5.7	7.28	28	Ch				
# ALIVE	9				5								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

AT - See Misc Doc.

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY #7814-15					SAMPLE ID: F1-SEDSMP				DILUENT: Hampton Estuary		START DATE:		
DAY	REP A				REP B				REP C				INITIALS
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	
0	21	6.9	7.99	29	21	6.9	8.00	29	21	6.9	7.95	29	SL
1	22	7.1	7.74	31	22	6.9	7.91	31	22	6.8	7.98	31	SL
2	22	6.8	7.78	30	22	7.0	8.03	30	22	7.0	8.05	30	—
3	22	7.3	8.14	28	22	7.4	8.16	29	22	7.5	8.17	29	—
4	22	6.9	8.14	28	22	6.7	8.29	28	22	6.7	8.32	28	111
5	22	6.8	8.43	30	22	6.8	8.58	30	22	6.7	8.51	30	2145
6	22	6.9	8.43	29	22	7.0	8.58	29	22	7.0	8.58	29	—
7	22	6.8	8.46	29	22	6.9	8.49	29	22	6.9	8.48	29	—
8	21	7.5	8.40	29	21	7.5	8.33	30	21	7.5	8.36	30	SL
9	21	5.9	8.45	29	21	6.1	8.44	30	21	6.3	8.44	29	111
10	21	6.1	8.33	29	21	6.1	8.33	29	21	6.1	8.35	29	CL
# ALIVE	9				10				13				

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	6.9	8.00	29	21	6.8	7.90	29	SL	///	///	///	///
1	22	7.0	8.04	31	22	6.9	8.04	31					
2	22	7.0	8.06	29	22	7.1	8.07	29					
3	22	7.4	8.17	29	22	7.4	8.16	29					
4	22	6.8	8.27	28	22	6.6	8.26	28					
5	22	6.8	8.44	30	22	6.8	8.42	30	NR				
6	22	7.0	8.47	30	22	6.9	8.46	29					
7	22	6.9	8.47	30	22	6.9	8.46	29					
8	21	7.5	8.38	31	21	7.5	8.48	30					
9	21	5.9	8.45	30	21	6.0	8.52	30					
10	21	6.3	8.38	29	21	6.0	8.45	30	CL				
# ALIVE	14				9								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

***Ampelisca abdita* CHRONIC EXPOSURE SEDIMENT ASSAY**

STUDY #7814 -16				SAMPLE ID: F-2.SED.SMP				DILUENT: Hampton Estuary				START DATE:			
DAY	REP A				REP B				REP C				INITIALS		
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL			
0	21	6.6	8.01	29	21	6.6	7.99	29	21	6.7	7.98	29	8		
1	22	6.4	8.03	31	22	6.6	8.04	31	22	6.6	8.06	31	11		
2	22	6.7	8.10	29	22	6.9	8.10	30	22	7.0	8.11	30	—		
3	22	7.4	8.13	27	22	7.5	8.11	28	22	7.4	8.10	29	—		
4	22	6.5	8.10	27	22	6.9	8.08	27	22	6.6	8.07	28	11		
5	22	6.8	8.14	30	22	6.8	8.12	30	22	6.8	8.09	30	21		
6	22	7.1	8.16	29	22	7.1	8.11	29	22	7.1	8.10	29	—		
7	22	6.9	8.09	28	22	6.9	8.00	28	22	6.7	7.86	28	—		
8	21	7.5	7.65	28	21	7.5	7.96	30	21	7.4	7.86	29	C		
9	21	6.2	8.27	28	21	6.3	8.18	30	21	6.1	8.02	28	11		
10	21	5.9	8.18	28	21	6.1	8.08	29	21	6.3	7.97	29	21		
# ALIVE	17				12				15				14		

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	6.7	7.98	29	21	6.8	7.96	29	8	11	11	11	11
1	22	6.4	8.07	31	22	6.9	8.04	31					
2	22	7.0	8.10	30	22	6.9	8.08	30					
3	22	7.4	8.08	29	22	7.5	8.08	29					
4	22	6.9	8.06	28	22	6.7	8.06	27					
5	22	6.8	8.12	30	22	6.8	8.10	30	21				
6	22	7.2	8.08	29	22	7.0	8.06	30					
7	22	6.8	7.92	29	22	6.8	7.92	28					
8	21	7.4	7.97	31	21	7.5	7.92	30					
9	21	6.3	8.06	30	21	6.3	8.05	29					
10	21	6.2	8.04	29	21	6.4	8.04	28	C				
# ALIVE	16				16								

- \* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.

**Ampelisca abdita CHRONIC EXPOSURE SEDIMENT ASSAY**

Ampelesca abdita CHRONIC EXPOSURE SEDIMENT ASSAY														
STUDY # 7814-17					SAMPLE ID: F-3. SED-SMP				DILUENT: Hampton Estuary			START DATE:		
DAY	REP A				REP B				REP C				INITIALS	
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL		
0	20	6.6	8.04	28	21	6.5	8.06	28	21	6.5	8.08	28	X	
1	22	6.5	8.06	30	22	6.6	8.07	30	22	6.5	8.10	30	lib	
2	22	6.6	8.11	29	22	6.8	8.16	30	22	7.0	8.18	30	—	
3	22	7.3	8.08	28	22	7.4	8.12	28	22	7.5	8.14	28	—	
4	22	6.1	8.11	29	22	6.8	8.16	30	22	6.6	8.12	29	lib	
5	22	6.8	8.18	30	22	6.7	8.18	30	22	6.8	8.18	30	XFS	
6	22	7.1	8.18	29	22	7.1	8.18	29	22	7.1	8.17	29	—	
7	22	6.8	8.15	27	22	7.0	8.14	23	22	7.0	8.13	21	—	
8	21	7.4	8.29	27	21	7.4	8.19	29	21	7.4	8.18	27		
9	21	6.1	8.31	28	21	6.3	8.42	28	21	6.2	8.41	29	lib	
10	21	5.9	8.33	28	21	6.1	8.89	28	21	6.3	8.31	29	Cf	
# ALIVE	14				12				16				14	

DAY	REP D				REP E				AMMONIA*				
	TEMP	D.O.	pH	SAL	TEMP	D.O.	pH	SAL	A	B	C	D	E
0	21	6.5	8.03	28	21	6.5	8.08	28	X	/	/	/	/
1	22	6.2	8.08	30	22	6.3	8.10	30					
2	22	7.0	8.17	30	22	7.0	8.15	29					
3	22	7.4	8.15	28	22	7.4	8.15	28					
4	22	6.6	8.12	28	22	6.8	8.13	28					
5	22	6.9	8.17	30	22	6.8	8.17	30	XFS				
6	22	7.1	8.16	28	22	7.1	8.16	28					
7	22	6.9	8.12	28	22	6.9	8.09	28					
8	21	7.5	8.05	29	21	7.5	8.07	29					
9	21	6.3	8.26	29	21	6.1	8.21	29					
10	21	6.3	8.31	29	21	6.3	8.14	28	Cf				
# ALIVE	13				10								

\* - Ammonia values on Day 0 were measured on the porewater. Ammonia on Days 5 and 10 were measured on the overlying water.



## DOCUMENTATION FORM

STUDY No.: 7814 STUDY DIRECTOR: K. Simon  
PROJECT TITLE: Raymar 1999- HA10DCR  
GENERATED BY: N. Harris DATE: 4/22/99

The following information is

- ☒ Miscellaneous Documentation
- ☐ A Deviation from the Protocol
- ☐ A Deviation from SOP \_\_\_\_\_

A pore water sample was taken from each  
test sediment. Samples were evaluated  
for Ammonia

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

## DOCUMENTATION FORM

STUDY No.: 7814 STUDY DIRECTOR: H. Simon  
PROJECT TITLE: SAIC - Raymar 1999  
GENERATED BY: W. Harris DATE: 4/23/99

The following information is

- ☒ Miscellaneous Documentation  
☐ A Deviation from the Protocol  
☐ A Deviation from SOP \_\_\_\_\_

pH of the overlying water initially ranged  
from 3.71 su to 4.41 su.

In order to raise pH, overlying water was  
decanted & replenished with fresh sea water &  
allowed to settle.

New pH values were:

A 6.53

B 6.51

C 6.45

D 6.53

E 6.54

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

## DOCUMENTATION FORM

STUDY No.: 7814 STUDY DIRECTOR: K. Simon

PROJECT TITLE: SAIC

GENERATED BY: P. Lyman DATE: 4/25/94

The following information is



Miscellaneous Documentation



A Deviation from the Protocol



A Deviation from SOP

pH of the overlying water initially ranged  
from 5.04 to 6.24

In order to raise pH overlying water was  
de-aerated - replenished with fresh salt  
water & allowed to settle

New pH values were:

A 6.36

B 6.35

C 6.33

D 6.34

E 6.40

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

# ESI SAMPLE RECEIPT RECORD

EnviroSystems, Inc.  
P.O. Box 772, One Lafayette Road  
Hampton, N.H. 03842  
(603) 926-3345

ESI STUDY NUMBER: 78/4

SAMPLE RECEIPT DATE: 4/20/99 TIME: 1000 am

SAMPLE RECEIVED BY: BB

DELIVERED VIA: ☒ FED X ☐ CARRIER ☐ CLIENT ☐ COURIER

## SAMPLE CONDITION:

CHAIN OF CUSTODY: ☒ YES ☐ NO

CHAIN OF CUSTODY SIGNED: ☒ YES ☐ NO

CHAIN OF CUSTODY COMPLETE:

SAMPLE DATE: ☒ YES ☐ NO

SAMPLE TIME RECORDED: ☒ YES ☐ NO

SAMPLE TYPE IDENTIFIED: ☒ YES ☐ NO

CUSTODY SEAL IN PLACE: ☒ YES ☐ NO

SHIPPING CONTAINER INTACT: ☒ YES ☐ NO

SAMPLE TEMPERATURE (AT ARRIVAL):        °C

COMMENTS: 17 x 1 gal Sediment

See Attached Note Doc

COOLER NUMBER: Green Igloo (not)

127  
~~115~~ 115  
206  
232

Science Applications International Corporation

Chain of Custody Record

Environmental Testing Center / 165 Dean Knave Dr. / Narragansett, RI 02882 / Tel. (401) 782-1900 / Fax (401) 782-2330

Project: <b>RAYMARK 1994</b>	Client Name and Contact: <b>USACE</b>
------------------------------	---------------------------------------

Sample No.	Containers No. Type	Collection Date Time	Sample Description	Requested Parameters
C-1-SED-SMP	1 gal	4/16 2:20	SEDIMENT (GRAB)	TOXICITY
D-2-SED-SMP	1	1:37		
D-3-SED-SMP	1	12:50		
D-1-SED-SMP	1	12:16		
D-2-SED-SMP	1	12:35		
D-3-SED-SMP	1	2:00		
D-4-SED-SMP	1	10:20		
D-5-SED-SMP	1	2:45		
D-6-SED-SMP	1	1:20		
D-6-SED-FD	1	3:07		
E-1-SED-SMP	1	10:55		
E-2-SED-SMP	1	9:50		
E-3-SED-SMP	1	11:15		
E-4-SED-SMP	1	11:21		
E-2F-1-SED-SMP	1	2:35		

Total: **15**

Packed/Released By: <b>SAIC</b> Signature: <i>[Signature]</i> Printed Name: <b>Cornelia Huelke</b> Date Time: <b>4/19/99 4:30 PM</b>	Received By: <b>ESL</b> Signature: <i>[Signature]</i> Printed Name: <b>Bryan Bozby</b> Date Time: <b>4/20/99 1000 AM</b>	Remarks: SAMPLES WERE REFRIGERATED UNTIL RELEASED. <i>CM 4/16/99 - 4/19/99</i>
Released By: Signature: Printed Name:	Received By: Signature: Printed Name:	
Final Destination: <b>ENVIROSYSTEMS INC</b>	Contact Name and Phone Number: <b>PETRA KARIBE</b> <b>603 926 3345</b>	
Shipping Method: <b>Fed Ex</b>	Page <b>1</b> of <b>2</b>	

Cornelia Fax 401 819 1585

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Chain of Custody Record

Environmental Testing Center / 165 Dean Knauss Dr. / Narragansett, RI 02882 / Tel. (401) 782-1900 / Fax (401) 782-2330

Project: <u>RAYMARK 1999</u>					Client Name and Contact: <u>USACE</u>		
Sample No.	Containers No.	Type	Collection Date	Time	Sample Description	Requested Parameters	
F-2-SED-SMP	1	1gal	4/16	12:00	SEDIMENT (GRAB)	-	TOXICITY
F-3-SED-SMP	1	1gal	4/16	5:25	SEDIMENT (GRAB)	-	TOXICITY
Total: <u>2</u>							

Packed/Released By: <u>SAC</u>		Date Time	Received By:	Date Time	Remarks: <u>SAMPLES WERE REFRIGERATED UNTIL RELEASED on 4/16/99</u> <u>4/19/99</u>
Signature: <u>[Signature]</u>		<u>4/19/99</u>	Signature: <u>[Signature]</u>	<u>4/19/99</u>	
Printed Name: <u>Cornelia Huelber</u>		<u>4:50 PM</u>	Printed Name: <u>Brian Buzby</u>	<u>1000am</u>	
Released By:		Date Time	Received By:	Date Time	
Signature:			Signature:		
Printed Name:			Printed Name:		
Final Destination: <u>ENVIRONMENTAL SYSTEMS, INC.</u>		Contact Name and Phone Number <u>PATRA KARBE</u> <u>6039263345</u>			
Shipping Method: <u>FED EX</u>		Page <u>2</u> of <u>2</u>			

CORNELIA FAX 401 849 1585

# DOCUMENTATION FORM

STUDY No.: 7814 STUDY DIRECTOR: K. Simon  
 PROJECT TITLE: SAIC - Raymar 2 1995  
 GENERATED BY: N. Harris DATE: 4/20/95

The following information is

- ☒ Miscellaneous Documentation  
☐ A Deviation from the Protocol  
☐ A Deviation from SOP \_\_\_\_\_

EST #	SAIC #	Amount
7814-1	C-1-SED-SMP	1x1g
7814-2	C-2-SED-SMP	1x1g
7814-3	C-3-SED-SMP	1x1g
7814-4	D-1-SED-SMP	1x1g
7814-5	D-2-SED-SMP	1x1g
7814-6	D-3-SED-SMP	1x1g
7814-7	D-4-SED-SMP	1x1g
7814-8	D-5-SED-SMP	1x1g
7814-9	D-6-SED-SMP	1x1g
7814-10	D-6-SED-FD	1x1g
7814-11	E-1-SED-SMP	1x1g
7814-12	E-2-SED-SMP	1x1g
7814-13	E-3-SED-SMP	1x1g
7814-14	E-4-SED-SMP	1x1g
7814-15	F-1-SED-SMP	1x1g
7814-16	F-2-SED-SMP	1x1g
7814-17	F-3-SED-SMP	1x1g

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

**APPENDIX C**  
**QA/C AND DATA VALIDATION**




APPENDIX C-1  
SEDIMENT CHEMISTRY



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## MEMORANDUM

**Date:** May 28, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Sediment Data Validation  
Sediment Set 1 - Pesticide data for 10 samples

---

As requested, I have reviewed the results of the 1999 Raymark sediment sample data for the organochlorine pesticide analyses in Set 1. The analyses were performed by The Woods Hole Group (WHG), on 10 samples collected by SAIC on April 15, 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
HB-1-SED-SMP	42279-1
HB-2-SED-SMP	42279-2
HB-3-SED-SMP	42279-3
HB-4-SED-SMP	42279-4
HB-5-SED-SMP	42279-5
HB-6-SED-SMP	42279-6
HB-6-SED-FD	42279-7
HB-7-SED-SMP	42279-8
HB-8-SED-SMP	42279-9
HB-9-SED-SMP	42279-10

This data validation effort approximates a Tier II validation, using the EPA Region 1 data validation guidance. It is important to note that the Region 1 guidance is intended for samples other than sediments and analyzed by CLP methods, which are not the methods designated for this project.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks

- Matrix spike and matrix spike duplicate results
- Laboratory control sample results
- Surrogate recoveries
- Endrin and DDT breakdown

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

As noted by the laboratory, the use of the amino-propyl cleanup column does not provide consistent recoveries of the target analyte endrin aldehyde. According to the narrative, the situation was discussed with SAIC and it was agreed that for this project, all endrin aldehyde results would be flagged "J" as estimated. Endrin aldehyde was not detected in any of the samples, thus all results for this analyte are reported as "UJ," for not detected and estimated. Unfortunately, the laboratory did not provide any data from reference materials, spiked samples, or laboratory control samples that included this analyte. Therefore, it is not possible to determine from the data in the package if the laboratory could have detected endrin aldehyde at all. Therefore, the reviewer suggests that the endrin aldehyde be deleted from the list of target analytes, or simply be reported as "NA" for not analyzed.

### **Calibrations**

Initial calibrations and continuing calibrations were performed as required. The results for several of the continuing calibration standards included one or more analytes that demonstrated a difference of more than 15% between the amount found and the true concentration of the standard. However, in every such instance, the results for the same standard analyzed on the second GC column were within the acceptance limits. Therefore, the laboratory reported the results for those analytes from the GC column that met the specifications. Most of the instances involved the amount found being greater than the true value, and many of the analytes were not found in any of the samples. The %D values in question were typically 16 to 21%, versus the 15% limit.

Given these calibration data, there is no reason to qualify any of the sample results.

### **Surrogate Recoveries**

The laboratory employed two surrogate compounds for these analyses, 4,4'-dibromooctafluorobiphenyl (DBOB) and the PCB congener BZ202. The recoveries of BZ202 were well above the upper limit of the laboratory's acceptance limits of 30-150% in the initial analyses of five of the field samples. The recoveries for HB-2-SED-SMP, HB-3-SED-SMP, HB-4-SED-SMP, HB-6-SED-SMP, and HB-6-SED-FD were all above 150%. However, given that there were relatively few target analytes detected in these samples and the recoveries of the other surrogate were within the acceptance limits, there is no reason to qualify the sample results due to high surrogate recoveries.

There were several instances noted by the laboratory of low recoveries of the DBOB surrogate. However, all of these occurred in the analyses of diluted sample extracts, and in each case, the initial, undiluted, analyses had acceptable DBOB recoveries. Since the recoveries in the initial analyses were acceptable, there is no reason to qualify the results from the diluted analyses due to surrogate concerns.

### Comparisons Between Results from Two GC Columns

SW-846 Method 8000B recommends that the quantitative results from both GC columns be compared during dual-column analyses such as used here for the pesticides. As noted by the laboratory, there were a two instances in which the quantitative results from the two GC columns used for the analyses differed by more than 40%. In those instances, the laboratory reviewed the chromatograms and if no evidence of a problem was found, they took the conservative approach and reported the higher of the two results. The results for o,p'-DDE in Sample HB-6-SED-FD and the results for p,p'-DDD in sample HB-7-SED-SMP were flagged "P" by the laboratory to indicate that the higher value was reported. The results for o,p'-DDE were 1.8 and 3.8 µg/kg on the two columns in HB-6-SED-SMP. The results for p,p'-DDD in sample HB-7-SED-SMP were 1.3 and 2.3. SAIC has reviewed the chromatograms for these samples and agrees that the higher values be reported and there is no need for qualification.

In sample HB-6-SED-SMP, the laboratory took the opposite approach, and after examining the chromatograms, they reported the lower value for p,p'-DDD in this sample. The result of 3.6 µg/kg was reported because the result of 5.7 was derived from a peak with an apparent positive interference. Similarly, in sample HB-6-SED-FD, the laboratory reported the results for p,p'-DDD as the lower of the two values 4.0 and 7.9 µg/kg. The lower results for both samples were flagged "I" by the laboratory. SAIC has reviewed the chromatograms for these samples agrees that the lower values be reported and there is no need for qualification.

### Field Duplicate Precision

Sample HB-6-SED-FD is a field duplicate. As part of this validation effort, the results for the field duplicate were compared to the original field sample, HB-6-SED-SMP. The RPDs between the results for each detected pesticide were calculated by the reviewer, and are shown below.

Analyte	HB-6-SED-SMP	HB-6-SED-FD	RPD
gamma-Chlordane	4.6 µg/kg	4.6 µg/kg	0%
o,p'-DDE	ND	3.8 µg/kg	NA
p,p'-DDT	ND	3.7 µg/kg	NA
p,p'-DDD	3.6 µg/kg	7.9 µg/kg	75%

Two of the analytes were not detected (ND) in the initial sample (-SMP), o,p'-DDE and p,p'-DDT. Therefore, no RPD calculation was possible and the RPD values are listed above as "NA" for not applicable. The gamma-Chlordane results indicated excellent precision, with RPD=0%. Conversely, the p,p'-DDD results exhibited poorer precision between these two samples, with an RPD=75%. However, these samples were taken from different cores collected

in approximately the same location and do not represent samples split from the same core. Thus, the precision for DDD may not be a major concern. Field duplicate precision is *not* within the control of the laboratory, but is discussed here in terms of the overall validation of the sampling and analysis effort.


### **Overall Assessment**

Overall, the results for these 10 samples meet the objectives of the sampling and analysis effort. The only qualification is that endrin aldehyde should not be considered to be a target analyte and the non-detect results for it should be considered to be "not analyzed" instead.



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## MEMORANDUM

**Date:** June 1, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Sediment Data Validation  
Sediment Set 2 - Pesticide data for 17 samples

---

As requested, I have reviewed the results of the 1999 Raymark sediment sample data for the organochlorine pesticide analyses in Set 2. The analyses were performed by The Woods Hole Group (WHG), on 17 samples collected by SAIC on April 16, 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
C-1-SED-SMP	42280-1
C-2-SED-SMP	42280-2
C-3-SED-SMP	42280-3
D-1-SED-SMP	42280-4
D-2-SED-SMP	42280-5
D-3-SED-SMP	42280-6
D-4-SED-SMP	42280-7
D-5-SED-SMP	42280-8
D-6-SED-SMP	42280-9
D-6-SED-FD	42280-10
E-1-SED-SMP	42280-11
E-2-SED-SMP	42280-12
E-3-SED-SMP	42280-13
E-4-SED-SMP	42280-14
F-1-SED-SMP	42280-15
F-2-SED-SMP	42280-16
F-3-SED-SMP	42280-17

This data validation effort approximates a Tier II validation, using the EPA Region 1 data validation guidance. It is important to note that the Region 1 guidance is intended for samples

other than sediments and analyzed by CLP methods, which are not the methods designated for this project.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike and matrix spike duplicate results
- Laboratory control sample results
- Surrogate recoveries
- Endrin and DDT breakdown

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

As noted by the laboratory, the use of the amino-propyl cleanup column does not provide consistent recoveries of the target analyte endrin aldehyde. According to the narrative, the situation was discussed with SAIC and it was agreed that for this project, all endrin aldehyde results would be flagged "J" as estimated. Endrin aldehyde was not detected in any of the samples, thus all results for this analyte are reported as "UJ," for not detected and estimated. Unfortunately, the laboratory did not provide any data from reference materials, spiked samples, or laboratory control samples that included this analyte. Therefore, it is not possible to determine from the data in the package if the laboratory could have detected endrin aldehyde at all. Therefore, the reviewer suggests that the endrin aldehyde be deleted from the list of target analytes, or simply be reported as "NA" for not analyzed.

### **Calibrations**

Initial calibrations and continuing calibrations were performed as required. The results for several of the continuing calibration standards included one or more analytes that demonstrated a difference of more than 25% between the amount found and the true concentration of the standard. However, in most such instances, the results for the same standard analyzed on the second GC column were within the acceptance limits. Therefore, the laboratory reported the results for those analytes from the GC column that met the specifications. Most of the instances involved the amount found being greater than the true value, and many of the analytes were not found in any of the samples.

The only exceptions were for the continuing calibration standards analyzed on 5/8/99 at 7:31 AM and 5/8/99 at 9:12PM. For the 7:31 AM standard, the results for Methoxychlor were above the acceptance limit on both columns A and B. Similarly, for the 9:12PM analysis, the results for gamma-BHC were above the limits on both columns. However, neither of these

compounds was reported as found in any of the samples. Since the continuing calibration standard results were higher than expected, there is no risk that the analytes may have been present in the samples but not detected because of the drift in the results for the continuing calibration standard.

Given these calibration data, there is no reason to qualify any of the sample results.

### Surrogate Recoveries

The laboratory employed two surrogate compounds for these analyses, 4,4'-dibromooctafluorobiphenyl (DBOB) and the PCB congener BZ202. The recoveries of BZ202 were well above the upper limit of the laboratory's acceptance limits of 30-150% in the analyses of two of the field samples. The BZ202 recoveries for D-5-SED-SMP and E-1-SED-SMP were above 250%. However, the only analyte detected was p,p'-DDD in sample D-5-SED-SMP. The recoveries of the other surrogate were within the acceptance limits in both samples. Therefore, there is no reason to qualify the sample results due to high surrogate recoveries.

### Comparisons Between Results from Two GC Columns

SW-846 Method 8000B recommends that the quantitative results from both GC columns be compared during dual-column analyses such as used here for the pesticides. As noted by the laboratory, there were a two instances in which the quantitative results from the two GC columns used for the analyses differed by more than 40%. In those instances, the laboratory reviewed the chromatograms and if no evidence of a problem was found, they took the conservative approach and reported the higher of the two results. Results were flagged "P" in the following samples:

SAIC Sample ID	Analyte	Result Reported with "P" Flag
D-4-SED-SMP	p,p'-DDD	3.7 P
D-5-SED-SMP	p,p'-DDD	20 P
E-2-SED-SMP	p,p'-DDD	58 P
E-4-SED-SMP	p,p'-DDD	24 P
F-1-SED-SMP	p,p'-DDD	36 P
F-2-SED-SMP	p,p'-DDT	24 P

SAIC has reviewed the chromatograms for these samples and agrees that the higher values be reported and there is no need for qualification, *with one exception*. The results for p,p'-DDD in sample E-2-SED-SMP are also associated with one of the calibration verification standards with an analyte above the acceptance limits. In this instance, the p,p'-DDD continuing calibration results had a percent difference from the initial calibration of 44% on Column A. The laboratory reported the results for this compound as "58 P," using the data from Column A. SAIC disagrees, and believes that the results should be reported from Column B, as 23 µg/kg.



## Field Duplicate Precision

Sample D-6-SED-FD is a field duplicate. As part of this validation effort, the results for the field duplicate were compared to the original field sample, D-6-SED-SMP. The only analyte detected in either analysis was p,p'-DDD, reported at 1.8 µg/kg in sample D-6-SED-SMP. This analyte was not detected in the field duplicate. Therefore, the RPD calculation is not appropriate. These two samples were collected from different cores collected in approximately the same location and do not represent samples split from the same core. Field duplicate precision is *not* within the control of the laboratory, but is discussed here in terms of the overall validation of the sampling and analysis effort.

## Overall Assessment

Overall, the results for these 17 samples meet the objectives of the sampling and analysis effort. Only two qualifications were made by the reviewer:

- Endrin aldehyde should not be considered to be a target analyte and the non-detect results for it should be considered to be "not analyzed" instead.
- The p,p'-DDD result in sample E-2-SED-SMP should be revised to 23 µg/kg, instead of the "58 P" value reported by the laboratory.



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## MEMORANDUM

**Date:** May 28, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty *73*  
**Subject:** Raymark 1999 Sediment Data Validation  
Sediment Set 1 - PCB congener data for 10 samples

---

As requested, I have reviewed the results of the 1999 Raymark sediment sample data for the PCB congener analyses in Set 1. The analyses were performed by The Woods Hole Group (WHG), on 10 samples collected by SAIC on April 15, 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
HB-1-SED-SMP	42279-1
HB-2-SED-SMP	42279-2
HB-3-SED-SMP	42279-3
HB-4-SED-SMP	42279-4
HB-5-SED-SMP	42279-5
HB-6-SED-SMP	42279-6
HB-6-SED-FD	42279-7
HB-7-SED-SMP	42279-8
HB-8-SED-SMP	42279-9
HB-9-SED-SMP	42279-10

This data validation effort approximates a Tier II validation, using the EPA Region I data validation guidance. It is important to note that the Region I guidance is intended for samples other than sediments and analyzed by CLP methods, which are not the methods designated for this project.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks

- Matrix spike and matrix spike duplicate results
- Laboratory control sample results
- Surrogate recoveries

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

### **Calibrations**

Initial calibrations and continuing calibrations were performed as required. The results for several of the continuing calibration standards included one or more analytes that demonstrated a difference of more than 15% between the amount found and the true concentration of the standard. However, in every instance but one, the results for the same standard analyzed on the second GC column were within the acceptance limits. Therefore, the laboratory reported the results for those analytes from the GC column that met the specifications.

The exception was for the calibration verification analyzed on May 10, 1999, at 2:18 PM. In this instance, the %D values for the surrogate 4,4'-dibromooctafluorobiphenyl (DBOB) were both outside the 15% acceptance limit (-26% for Channel A and -22% for Channel B). Three field samples were analyzed after that verification standard: HB-3-SED-SMP, and the diluted analyses of both HB-2-SED-SMP and HB-6-SED-FD. Given that the latter two samples were diluted analyses and the surrogate recoveries in both the initial and diluted analyses met the QC limits, there is no need to qualify the sample results. For HB-3-SED-SMP, the surrogate recovery for DBOB was well within the acceptance limits, so no qualification is necessary either.

### **Surrogate Recoveries**

The laboratory employed two surrogate compounds for these analyses, 4,4'-dibromooctafluorobiphenyl (DBOB) and the PCB congener BZ202. The recoveries of BZ202 were well above the upper limit of the laboratory's acceptance limits of 30-150% in the initial analyses of five of the field samples. The recoveries for HB-2-SED-SMP, HB-3-SED-SMP, HB-4-SED-SMP, HB-6-SED-SMP, and HB-6-SED-FD were all above 150%. The laboratory attributed the high recoveries to a matrix interference and analyzed a dilution of each extract. The BZ202 recovery remained high in each diluted extract analysis, indicating that the interference was likely due to a matrix effect.

Given the high recoveries and the fact that they were reproducible upon dilution, SAIC does not believe that qualification of any samples results is warranted.

### **Comparisons Between Results from Two GC Columns**

SW-846 Method 8000B recommends that the quantitative results from both GC columns be compared during dual-column analyses such as used here for the PCBs. As noted by the

laboratory, there were a number of instances in which the quantitative results from the two GC columns used for the analyses differed by more than 40%. In those instances, the laboratory reviewed the chromatograms and if no evidence of a problem was found, they took the conservative approach and reported the higher of the two results, flagging those values with a "P" to indicate that the higher value was reported.

If, after examining the chromatograms, they found evidence of a positive interference on one of the columns, or if there was evidence that the baseline had been incorrectly established by the software, the laboratory reported the lower of the two results, flagging those values with a "I" to indicate that the lower value was reported, due to an interference.

SAIC has reviewed the chromatograms for these samples and agrees that the laboratory's reported results were appropriate and there is no need for qualification of the results.

### Field Duplicate Precision

Sample HB-6-SED-FD is a field duplicate. As part of this validation effort, the results for the field duplicate were compared to the original field sample, HB-6-SED-SMP. The RPDs between the results for each detected pesticide were calculated by the reviewer, and are shown below.

Analyte	HB-6-SED-SMP	HB-6-SED-FD	RPD
PCB52	3.3	ND	NA
PCB66	ND	3.9	NA
PCB101	8.3	9.8	17%
PCB105	ND	2.3	NA
PCB118	ND	2.6	NA
PCB126	9.9	10	1%
PCB138	5.2	6.9	3%
PCB153	7.0	7.9	14%
PCB170	5.0	5.4	8%
PCB180	30	36	18%
PCB187	26	27	4%
PCB195	11	13	17%
PCB200	4.8	6.8	34%
PCB206	65	100	42%
PCB209	10	13	26%

Four of the analytes were not detected (ND) in either the original sample or the duplicate sample. Therefore, no RPD calculation was possible and the RPD values are listed above as "NA" for not applicable. The results for the sample in which these congeners were detected are all only slightly above the laboratory's reporting limits, and therefore, the detect/nondetect situation is not unexpected.

The results for the eight analytes that were detected in both analyses indicate excellent precision, with all RPD values less than 20%. The last three PCB congeners exhibited lesser precision, but still had RPD values less than 45%. PCB206 had the highest RPD value, 42%, and involved the results from a diluted analysis of the field duplicate sample. The dilution of the sample extract may have introduced some portion of the difference between these two results.

These samples were taken from different cores collected in approximately the same location and do not represent samples split from the same core. The precision exhibited by these results is well within the expected range for field duplicate samples, and there is no reason to qualify any sample results. Field duplicate precision is *not* within the control of the laboratory, but is discussed here in terms of the overall validation of the sampling and analysis effort.


### **Overall Assessment**

Overall, the results for these 10 samples meet the objectives of the sampling and analysis effort. The results may be used without qualification.



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## MEMORANDUM

**Date:** June 2, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Sediment Data Validation  
Sediment Set 2 - PCB congener data for 17 samples

---

As requested, I have reviewed the results of the 1999 Raymark sediment sample data for the PCB congener analyses in Set 2. The analyses were performed by The Woods Hole Group (WHG), on 17 samples collected by SAIC on April 16, 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
C-1-SED-SMP	42280-1
C-2-SED-SMP	42280-2
C-3-SED-SMP	42280-3
D-1-SED-SMP	42280-4
D-2-SED-SMP	42280-5
D-3-SED-SMP	42280-6
D-4-SED-SMP	42280-7
D-5-SED-SMP	42280-8
D-6-SED-SMP	42280-9
D-6-SED-FD	42280-10
E-1-SED-SMP	42280-11
E-2-SED-SMP	42280-12
E-3-SED-SMP	42280-13
E-4-SED-SMP	42280-14
F-1-SED-SMP	42280-15
F-2-SED-SMP	42280-16
F-3-SED-SMP	42280-17

This data validation effort approximates a Tier II validation, using the EPA Region 1 data validation guidance. It is important to note that the Region 1 guidance is intended for samples

other than sediments and analyzed by CLP methods, which are not the methods designated for this project.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike and matrix spike duplicate results
- Laboratory control sample results
- Surrogate recoveries

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

### **Calibrations**

Initial calibrations and continuing calibrations were performed as required. The results for two of the continuing calibration standards included one or more analytes that demonstrated a difference of more than 25% between the amount found and the true concentration of the standard. However, in both instances, the results for the same standard analyzed on the second GC column were within the acceptance limits. Therefore, the laboratory reported the results for those analytes from the GC column that met the specifications.

### **Surrogate Recoveries**

The laboratory employed two surrogate compounds for these analyses, 4,4'-dibromooctafluorobiphenyl (DBOB) and the PCB congener BZ202. Samples D-5-SED-SMP and E-1-SED-SMP required large dilutions of the extracts in order to bring all of the target congeners within the calibration range of the instrument. As a result of these large dilutions, the surrogates were diluted out in the final analyses. Given the extent of the required dilutions, this is not surprising and is not cause to qualify the results for these samples. The laboratory reported the undiluted results for D-5-SED-SMP, which, while the PCB congener results themselves are not usable, do indicate acceptable surrogate recoveries.

### **Comparisons Between Results from Two GC Columns**

SW-846 Method 8000B recommends that the quantitative results from both GC columns be compared during dual-column analyses such as used here for the PCBs. As noted by the laboratory, there were a number of instances in which the quantitative results from the two GC columns used for the analyses differed by more than 40%. In those instances, the laboratory reviewed the chromatograms and if no evidence of a problem was found, they took the

conservative approach and reported the higher of the two results, flagging those values with a "P" to indicate that the higher value was reported.

If, after examining the chromatograms, they found evidence of a positive interference on one of the columns, or if there was evidence that the baseline had been incorrectly established by the software, the laboratory reported the lower of the two results, flagging those values with a "I" to indicate that the lower value was reported, due to an interference.

SAIC has reviewed the chromatograms for these samples and agrees that the laboratory's reported results were appropriate and there is no need for qualification of the results.

### Field Duplicate Precision

Sample D-6-SED-FD is a field duplicate. As part of this validation effort, the results for the field duplicate were compared to the original field sample, HB-6-SED-SMP. The RPDs between the results for each detected pesticide were calculated by the reviewer, and are shown below.

Analyte	D-6-SED-SMP	D-6-SED-FD	RPD
PCB28	1.3	--	NA
PCB52	2.3	--	NA
PCB66	--	1.9	NA
PCB105	1.7	--	NA
PCB138	1.4	--	NA
PCB153	2.2	--	NA
PCB180	3.9	7.7	66
PCB187	3.2	3.5	9
PCB188	1.2	1.5	22
PCB195	1.1	2.0	58
PCB206	4.0	5.1	24

Six of the analytes were not detected (ND) in either the original sample or the duplicate sample. Therefore, no RPD calculation was possible and the RPD values are listed above as "NA" for not applicable. The results for many of the samples in which these congeners were detected are only slightly above the laboratory's reporting limits, and therefore, the detect/nondetect situation is not unexpected.

These samples were taken from different cores collected in approximately the same location and do not represent samples split from the same core. The precision exhibited by these results is generally within the expected range for field duplicate samples, and there is no reason to qualify any sample results. Field duplicate precision is *not* within the control of the laboratory, but is discussed here in terms of the overall validation of the sampling and analysis effort.



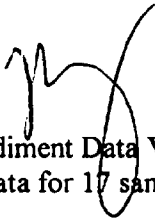
### **Overall Assessment**

Overall, the results for these 17 samples meet the objectives of the sampling and analysis effort. The results may be used without qualification.



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## MEMORANDUM

**Date:** June 17, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Sediment Data Validation  
Sediment dioxin data for 17 samples

---

As requested, I have reviewed the results of the 1999 Raymark sediment data for PCDDs/PCDFs. The analyses were performed by Midwest Research Institute (MRI) on 17 sediment samples collected by SAIC in April 1999. The laboratory used the SAIC sample numbers, as shown below:

SAIC Sample ID	
C-1-SED-SMP	D-6-SED-FD
C-2-SED-SMP	E-1-SED-SMP
C-3-SED-SMP	E-2-SED-SMP
D-1-SED-SMP	E-3-SED-SMP
D-2-SED-SMP	E-4-SED-SMP
D-3-SED-SMP	F-1-SED-SMP
D-4-SED-SMP	F-2-SED-SMP
D-5-SED-SMP	F-3-SED-SMP
D-6-SED-SMP	

While an attempt was made to perform a Tier II validation, using the EPA Region 1 data validation guidance, the level of validation that was possible for these results was very limited. Although the method employed, Method 1613B, contains an extensive quality control protocol, the data there were provided are limited to tabular summaries of the results for the samples, the recoveries of the isotopically-labeled compounds added to the sample prior to extraction, and the laboratory control sample (LCS) results. No raw data were provided, nor were any data on mass calibration, the window defining mixture analyses, initial calibration, calibration verification, or the ion abundance ratios.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Blanks
- Labeled compound recoveries
- Laboratory control sample results
- Compound identification

The results were evaluated in the context of the requirements of Method 1613B. Where no comments are made, no problems were identified.

### **Blanks**

The laboratory provided summary data for two method blanks. The first blank was associated with 16 of the samples. The second blank was associated with one sample, D-5-SED-SMP, that required re-extraction by the laboratory due to a malfunction of the gel permeation chromatography (GPC) cleanup apparatus.

Only four of the 17 target analytes were found in the methods blanks. 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,6,7,8-HpCDD, OCDF, and OCDD were detected in both blanks at low levels. The reviewers have used the "5 times" rule to qualify any sample results that are not at least 5 times the associated blank result. Only three sample results required qualification.

The 1,2,3,4,6,7,8-HpCDD and the 1,2,3,4,6,7,8-HpCDF results in D-1-SED-SMP were qualified as estimated and flagged "J," due to the blank results. The 1,2,3,4,6,7,8-HpCDF result in D-2-SED-SMP is similarly qualified. None of the OCDD or OCDF results were qualified.

The reporting practices used by MRI lead to some confusion with regard to analytes found in the blanks. See the discussion of compound identification later in this review.

### **Labeled Compound Recoveries**

<sup>13</sup>C-labeled analogs of the target analytes are added to each sample prior to extraction and the recoveries of those compounds are used to perform isotope dilution quantitation of the target analytes. The method contains acceptance criteria for the labeled compounds in the form of limits for the percent recovery. MRI has used the consensus limits of 25-150% from the original publication of Method 1613. Since that time, EPA has slightly revised and widened those limits as a result of a interlaboratory study of the method.

MRI flagged two recoveries as being outside of their in-house limit. The recovery of <sup>13</sup>C-2,3,7,8-TCDF was flagged in samples E-3-SED-SMP and E-4-SED-SMP. Sample F-2-SED-SMP also had a recovery outside of MRI's in-house limits, but it was not flagged in the data summary. Based on the latest EPA acceptance criteria, this labeled standard should be recovered in the range 24-169%. The recovery in E-4-SED-SMP was reported as 23.8%, which when rounded to the appropriate number of significant figures becomes 24%, and falls within the method-specified acceptance limit. Therefore, there is no issue for that sample. The recoveries in the E-3-SED-SMP and F-2-SED-SMP were reported as 12.7% and 20.7%, respectively, and both

values are outside the method-specified limits. Therefore, the results for 2,3,7,8-TCDF in these two samples are qualified as estimates, and flagged "J" by the reviewers.

### **Compound Identification**

Method 1613 includes specific requirements for identifying a compound as one of the 17 2,3,7,8-substituted PCDDs/PCDFs that are the target analytes in the method. Among those requirements is the ratio of the two characteristic ions that are monitored for each analyte. If that ratio falls outside of a consensus window for the analyte, then the peaks cannot be definitively identified as the analyte, and the results may include a contribution from some non-target analyte. The laboratory will then typically report the results as a worst case estimate called an estimated maximum possible concentration (EMPC).

The laboratory employed an unusual reporting scheme for these samples, in that they often reported results as "U (###) EMPC," where "###" represents the sample-specific detection limit calculated on the basis of the observed noise. The EMPC qualifier normally indicates that the results did not meet the ion abundance ratio criteria for identifying a target analyte. The reviewers have questioned the laboratory about this practice, and as a result of those discussions, any results reported by MRI in this fashion are considered to be not detected (e.g., "U") at the detection limit reported in parentheses. MRI's unusual use of the EMPC qualifier essentially indicates that the detection limit is a worst case limit for this sample. SAIC does not believe that there is a meaningful difference between the worst case detection limit and a noise-based detection limit that would be reported otherwise.

In addition, to the method specifications for the ion abundance ratio, the GC column used for the analysis cannot absolutely separate 2,3,7,8-TCDF from other TCDF isomers. Therefore, the method specifies that whenever 2,3,7,8-TCDF is found in a sample, the sample extract should be reanalyzed on a different GC column that can separate the TCDF isomers, but that is not suitable for the analysis of all of the other target analytes. MRI reported 2,3,7,8-TCDF in 14 of the 17 sediment samples. Based on a conversation with the laboratory, they will provide the second column confirmation data as soon as possible. SAIC will review those results as soon as they are received.

*Given the need to validate these sample results quickly, SAIC will only revise this review in the event that the second column confirmation results demonstrate that 2,3,7,8-TCDF was not present in one of those 14 samples.*

Finally, the results for OCDD in sample E-1-SED-SMP was reported by the laboratory as 7900 pg/g, with a flag that indicated that the peak was saturated. Given this saturation of the detector, it may be possible that the reported concentration is lower than the true concentration. Therefore, SAIC has flagged that OCDD results as estimated.

### **Overall Assessment**

The majority of the results for the PCDDs/PCDFs in these 17 samples met the data quality objectives and may be used without qualification.

The results for 1,2,3,4,6,7,8-HpCDD and 1,2,3,4,6,7,8-HpCDF were flagged as estimates in sample D-1-SED-SMP and the 1,2,3,4,6,7,8-HpCDD result in D-2-SED-SMP was also flagged as an estimate.

All results reported by MRI with both the "U" and "EMPC" qualifiers are to be considered not detected and reported simply as "u" values.

The 2,3,7,8-TCDF results in samples E-3-SED-SMP and F-2-SED-SMP were flagged as estimates due to low recoveries of the associated labeled standard.


SAIC expects to receive the results for 2,3,7,8-TCDF confirmation of 14 of the 17 samples in the near future. *SAIC will only revise this review in the event that the second column confirmation results demonstrate that 2,3,7,8-TCDF was not present in one of those 14 samples.*

**APPENDIX C-2**  
**SEDIMENT POREWATER CHEMISTRY**



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## MEMORANDUM

**Date:** June 11, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Sediment Data Validation  
Porewater metals data for 17 samples

---

As requested, I have reviewed the results of the 1999 Raymark porewater metals data. The analyses were performed by the University of Rhode Island (URI) Paleomagnetism Laboratory on 17 sediment samples collected by SAIC in April 1999. The laboratory used the SAIC sample numbers, as shown below:

SAIC Sample Number	
C-1-PW	D-6-FD
C-2-PW	E-1-PW
C-3-PW	E-2-PW
D-1-PW	E-3-PW
D-2-PW	E-4-PW
D-3-PW	F-1-PW
D-4-PW	F-2-PW
D-5-PW	F-3-PW
D-6-PW	

While an attempt was made to perform a Tier II validation, using the EPA Region 1 data validation guidance, the level of validation that was possible for these results was very limited. The data reported by URI are limited to tabular summaries only.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike results
- Duplicate samples
- Blank spikes

The results were evaluated in the context of the data quality objectives (DQOs) provided by the laboratory. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

The data package is limited to tabular summaries. No raw data were provided. Since this is a Tier II validation effort, the raw data were not absolutely needed, but the lack of raw data would limit any further evaluation in the future.

### **Calibration**

The graphite furnace atomic absorption spectrophotometer (GFAA) was calibrated for all eight metals and those calibrations met the linearity criteria described in the laboratory's data quality objectives. However, two of the continuing calibration blanks (CCBs) exceeded the target values for arsenic. One CCB in each of the two analysis batches reported by URI exceeded the acceptance limit of 5.0 µg/L, with both values at 5.6 µg/L. The laboratory's DQOs do not specify an allowance for any CCB results to exceed this value, nor would one be expected. There is no indication that the laboratory took any corrective action when the CCB results failed to meet the acceptance limits.

Arsenic was reported in six of the 17 samples, at levels ranging from 10.3 to 42.9 µg/L. The other 11 samples were all reported to be below the detection limit of 10.0 µg/L. The arsenic results for the method, or procedural, blank were reported as <10.0 µg/L, meeting the laboratory's DQOs. However, given the level of arsenic in the two CCBs and the low levels reported in four of the six positive samples, it is not possible to determine how much, if any, of those results were due to the background levels of arsenic in the laboratory. The validators have used the "five times rule" to evaluate these results, whereby any sample result less than five times the CCB result is considered to be an estimate of the sample concentration that may reflect a significant contribution from the CCB. The results for samples C-2-PW, E-1-PW, E-3-PW, and F-3-PW are all below 28 µg/L (5.6 x 5). Therefore, the arsenic results for these four samples are all flagged "J" as estimated. The arsenic results for sample C-1-PW and E-2-PW are not affected, since they are more than five times the CCB results. The non-detect results for the remaining samples are not affected.

### **Matrix Spike Results**

The laboratory reported the results for a matrix spike of sample C-1-PW. The laboratory's DQOs specify a recovery range of 50-150%, with no more than 30% of the analytes falling outside that range. For these samples, five of eight metals had matrix spike recoveries within the acceptance range, and three metals fell outside the limits. Thus, 37.5% of the metal recoveries fell outside of the acceptance limits. Arsenic, lead, and silver had recoveries of 35%, 30%, and 24% respectively, well below the laboratory's acceptance limits. There is no indication that the laboratory took any corrective action when more than 30% of the results failed to meet the acceptance limits.

The laboratory also analyzed a blank spike, or laboratory control sample, containing all eight metals. The recoveries of all of the metals were in the range of 71-103%, including



arsenic, lead and silver. These blank spike data indicate that the recovery problems may be associated with the porewater matrix itself. Thus, the issue is not necessarily one of laboratory performance, but rather the ability of the selected sample preparation procedures to determine the analytes in the porewater matrix.

Silver was not detected in any of the 17 porewater samples. Given the reported matrix spike recovery (24%), and without the raw data from the analyses, it is not possible to say that the silver results are not false negatives. Therefore, all the silver results are flagged "UJ" to indicate the uncertainty associated with the reported detection limits.

Arsenic and lead were each reported as present in six of the 17 samples, although both metals were not necessarily reported in the same sample. All but one of the lead results were only slightly above the reported detection limit (results ranged from 2.9 to 3.7  $\mu\text{g/L}$ , versus a detection limit of 2.9). Four of the six arsenic results were similarly close to the reported detection limit of 10  $\mu\text{g/L}$ .

The arsenic data for those four samples are already qualified as estimated due to the CCB issue described above. Given the reported matrix spike recovery, the non-detect results for arsenic in samples C-3-PW, D-1-PW, D-2-PW, D-3-PW, D-4-PW, D-5-PW, D-6-PW, D-6-FD, E-4-PW, F-1-PW, and F-2-PW are flagged as "UJ" to indicate the uncertainty associated with the reported detection limits.

The lead results for C-3-PW, D-1-PW, D-2-PW, D-3-PW, AND E-4-PW are flagged "J" as estimated due to the low matrix spike recovery. The non-detect results for C-1-PW, C-2-PW, D-4-PW, D-5-PW, D-6-PW, D-6-FD, E-1-PW, E-3-PW, F-1-PW, F-2-PW, and F-3-PW are flagged as "UJ" to indicate the uncertainty associated with the reported detection limits.

### **Duplicate Sample Results**

The laboratory analyzed one sample, D-4-PW, in duplicate. Unfortunately, this sample contained only two metals above the reported detection limits. Therefore, the precision of the analysis could only be assessed on the basis of those two results. The relative percent difference (RPD) was reported as 11% for chromium and 79% for zinc. The zinc results are well outside of the laboratory's 30% acceptance limit, but their DQOs allow for up to 35% of the analytes to fail this criterion (Note: The laboratory's DQO statement refers to the "recoveries," not the RPD, and is an obvious typographical error).

Zinc was reported as present in 14 of the 17 samples. Given the relatively high RPD for the duplicate analyses, all of the detected results have been flagged "J" as estimates. Only the non-detect results for C-1-PW, E-1-PW, and E-2-PW are unaffected.

### **Overall Assessment**

The results for the analyses of cadmium, chromium, copper, and nickel may all be used without qualification. However, all of the results for silver are non-detects and are qualified as estimates. The reported detection limits should be used with appropriate caution if silver is an analyte of concern at this site.

All of the non-detect results for arsenic and lead are similarly qualified due to low matrix spike recoveries and the reported detection limits should be used with appropriate caution if these analytes are of concern at this site.

A number of the results for samples in which either lead or arsenic were reported as detected are also qualified as estimates either due to the potential contributions from the blank (for arsenic) or due to low matrix spike recoveries (for arsenic and lead).

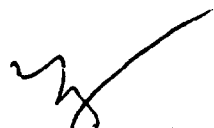
The reported results for zinc are qualified as estimates, due to the relatively poor precision between the duplicate analyses. This qualification may adversely affect comparisons of zinc results between different samples.

**APPENDIX C-3**  
**TISSUE CHEMISTRY**



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## MEMORANDUM

**Date:** June 25, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Tissue Data Validation  
Metals data for 9 samples

---

As requested, I have reviewed the results of the 1999 Raymark tissue sample data for the metals analyses. The analyses were performed by The Woods Hole Group (WHG), on 9 ribbed mussel samples collected by SAIC in April 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
C-1-TISS-SMP	42274-1
C-2-TISS-SMP	42274-2
C-3-TISS-SMP	42274-3
D-1-TISS-SMP	42274-4
D-2-TISS-SMP	42274-5
D-3-TISS-SMP	42274-6
D-4-TISS-SMP	42274-7
D-6-TISS-SMP	42274-8
HB-9-TISS-SMP	42274-9

This data validation effort approximates a Tier II validation, using the EPA Region 1 data validation guidance. It is important to note that the Region 1 guidance is intended for samples other than tissues and analyzed by CLP methods, which are not the methods designated for this project.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike and duplicate sample results



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- Laboratory control sample results
- ICP serial dilution results
- ICP interference check results
- Graphite furnace post-digestion spike results

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

#### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

#### **Duplicate Sample Results**

The laboratory performed a duplicate analysis of sample C-1-TISS-SMP. The precision results for all the metals were within the acceptance limits except for arsenic, cadmium, and nickel. The RPD for arsenic was 23.8%, 32% for cadmium, and 20.6% for nickel.

The precision for nickel is so close to the limit that no qualification of the data is needed. The precision for arsenic is only slightly outside the limit, while the cadmium results demonstrate more variability. Both metals were reported in all of the tissue samples. Therefore, all of the results for arsenic and cadmium are considered to be estimates and are flagged "J."

#### **Laboratory Control Sample**

The laboratory analyzed a standard reference material, SRM 2976, as a laboratory control sample. As noted by the laboratory, the results for chromium and cadmium were outside of the acceptance limits for this SRM. The recovery of cadmium was 37.5% and 134% for chromium. The laboratory attributes these recovery problems to a sample matrix interference.

SAIC has reviewed the results. Because the matrix spike results are well within the acceptance limits, there is no need to qualify the sample results for cadmium or chromium on the basis of the SRM results.

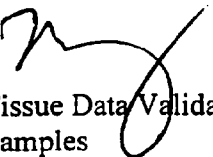
#### **Overall Assessment**

Overall, the majority of the results for these 9 tissue samples meet the objectives of the sampling and analysis effort and they may be used without qualifications. All results for arsenic and cadmium are flagged "J," as estimated, due to the difficulties noted with the duplicate analysis.



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## MEMORANDUM

**Date:** June 25, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Tissue Data Validation  
PAH data for 9 samples

---

As requested, I have reviewed the results of the 1999 Raymark tissue sample data for the PAH analyses. The analyses were performed by The Woods Hole Group (WHG), on 9 ribbed mussel samples collected by SAIC in April 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
C-1-TISS-SMP	42274-1
C-2-TISS-SMP	42274-2
C-3-TISS-SMP	42274-3
D-1-TISS-SMP	42274-4
D-2-TISS-SMP	42274-5
D-3-TISS-SMP	42274-6
D-4-TISS-SMP	42274-7
D-6-TISS-SMP	42274-8
HB-9-TISS-SMP	42274-9

This data validation effort approximates a Tier II validation, using the EPA Region 1 data validation guidance. It is important to note that the Region 1 guidance is intended for samples other than tissues and analyzed by CLP methods, which are not the methods designated for this project. Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike and matrix spike duplicate results
- Laboratory control sample results
- Surrogate recoveries

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

### **Laboratory Control Sample Results**

According to the narrative, the laboratory analyzed a standard reference material, SRM 1974a, in conjunction with these samples, as a laboratory control sample (LCS). The results for this SRM were reported with a recovery correction that was based on the recoveries of the four surrogates added to all the samples. According to the narrative, this recovery correction was made by the laboratory because the certified values for the SRM are based on the use of isotope dilution quantitation, which includes an inherent recovery correction for each analyte.

The reviewers disagree with this approach for two reasons. First and foremost, the use of any recovery correction bears no resemblance to the approach used for the analysis of the sediment samples. Thus, the SRM results and the laboratory's success in achieving the certified values for that SRM have little meaning in the context of this project.

Secondly, the use of the surrogate data to perform the recovery correction limits the utility of the results even further. In isotope dilution methods, an isotopically-labeled analog of each target compound is added to the sample prior to extraction. In the few instances where a labeled analog is not available or cannot be used for other reasons, the recovery correction is based on the recovery of the analog of a very similar compound. In these PAH analyses, only four surrogate compounds were employed for the 24 target compounds. While all four surrogates were deuterated analogs of target PAHs, only three of those target PAHs had certified values for the SRM. Thus, the SRM results were corrected on the basis of only three surrogates. Given the wide range of structures for the 16 target PAHs in the SRM, SAIC does not believe that one can make reasonable associations between the surrogates and the target analytes for the purposes of quantitation. It is this lack of a clear association between surrogates and target analytes that has kept EPA from employing recovery corrections based on surrogate results in their analytical methods.

The net effect on the quality of the data for this project is minimal, in that only the SRM results were recovery corrected. However, SAIC believes that this approach further limits the utility of the SRM analysis as a quality control measure in relation to the sample analyses. Because the MS/MSD results reported in the data package exhibit good recoveries and excellent precision, no qualification of the sample results is required in relation to SAIC's concerns about the SRM analysis.

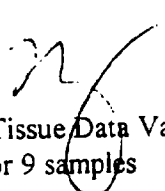
### **Overall Assessment**

Overall, the results for these 9 tissue samples meet the objectives of the sampling and analysis effort and they may be used without qualifications.



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## MEMORANDUM

**Date:** June 18, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Tissue Data Validation  
Pesticide data for 9 samples

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As requested, I have reviewed the results of the 1999 Raymark tissue sample data for the organochlorine pesticide analyses. The analyses were performed by The Woods Hole Group (WHG), on 9 ribbed mussel samples collected by SAIC in April 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
C-1-TISS-SMP	42274-1
C-2-TISS-SMP	42274-2
C-3-TISS-SMP	42274-3
D-1-TISS-SMP	42274-4
D-2-TISS-SMP	42274-5
D-3-TISS-SMP	42274-6
D-4-TISS-SMP	42274-7
D-6-TISS-SMP	42274-8
HB-9-TISS-SMP	42274-9

This data validation effort approximates a Tier II validation, using the EPA Region 1 data validation guidance. It is important to note that the Region 1 guidance is intended for samples other than tissues and analyzed by CLP methods, which are not the methods designated for this project.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike and matrix spike duplicate results



- Laboratory control sample results
- Surrogate recoveries
- Endrin and DDT breakdown

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

As noted by the laboratory, the use of the amino-propyl cleanup column does not provide consistent recoveries of the target analyte endrin aldehyde. According to the narrative, the situation was discussed with SAIC and it was agreed that for this project, all endrin aldehyde results would be flagged "J" as estimated. Endrin aldehyde was not detected in any of the samples, thus all results for this analyte are reported as "UJ," for not detected and estimated. Unfortunately, the laboratory did not provide any data from reference materials, spiked samples, or laboratory control samples that included this analyte. Therefore, it is not possible to determine from the data in the package if the laboratory could have detected endrin aldehyde at all. Therefore, the reviewer suggests that the endrin aldehyde be deleted from the list of target analytes, or simply be reported as "NA" for not analyzed.

### **Calibrations**

Initial calibrations and continuing calibrations were performed as required. The results for several of the continuing calibration standards included one or more analytes that demonstrated a difference of more than 25% between the amount found and the true concentration of the standard. However, in all but one such instance, the results for the same standard analyzed on the second GC column were within the acceptance limits. Therefore, the laboratory reported the results for those analytes from the GC column that met the specifications.

The exception was for hexachlorobenzene. The continuing calibration standard analyzed on 5/15/99 at 12:01 AM, after all of the tissue samples, had a %D on Column A of -28% and -35% on Column B. This analyte was not detected in any of the 9 tissue samples. SAIC examined the chromatograms and found no evidence of peaks that would represent this analyte. However, given the continuing calibration results, there is some slim chance that the results could be false negatives. Therefore, all of the non-detect results for this analyte are flagged "UJ" to indicate that the reported quantitation limits may be estimates.

### **Comparisons Between Results from Two GC Columns**

SW-846 Method 8000B recommends that the quantitative results from both GC columns be compared during dual-column analyses such as used here for the pesticides. As noted by the laboratory, there were a two instances in which the quantitative results from the two GC columns used for the analyses differed by more than 40%. In those instances, the laboratory reviewed the chromatograms and if no evidence of a problem was found, they took the conservative approach and reported the higher of the two results. The results for p,p'-DDE and p,p'-DDD in Sample D-

1-TISS-SMP were flagged "P" by the laboratory to indicate that the higher value was reported. SAIC has reviewed the chromatograms for these samples and agrees that the higher values be reported and there is no need for qualification.


#### **Overall Assessment**

Overall, the majority of the results for these 9 tissue samples meet the objectives of the sampling and analysis effort. The only qualifications are that endrin aldehyde should not be considered to be a target analyte and the non-detect results for it should be considered to be "not analyzed" instead, and all the reported quantitation limits for hexachlorobenzene are considered to be estimates and should be flagged "UJ."



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## MEMORANDUM

**Date:** June 25, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Tissue Data Validation  
PCB data for 9 samples

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As requested, I have reviewed the results of the 1999 Raymark tissue sample data for the PCB analyses. The analyses were performed by The Woods Hole Group (WHG), on 9 ribbed mussel samples collected by SAIC in April 1999. The SAIC and WHG sample numbers are as follows:

SAIC Sample ID	Woods Hole Group ID
C-1-TISS-SMP	42274-1
C-2-TISS-SMP	42274-2
C-3-TISS-SMP	42274-3
D-1-TISS-SMP	42274-4
D-2-TISS-SMP	42274-5
D-3-TISS-SMP	42274-6
D-4-TISS-SMP	42274-7
D-6-TISS-SMP	42274-8
HB-9-TISS-SMP	42274-9

This data validation effort approximates a Tier II validation, using the EPA Region 1 data validation guidance. It is important to note that the Region 1 guidance is intended for samples other than tissues and analyzed by CLP methods, which are not the methods designated for this project.

Our review efforts evaluated the summary level data only, and considered the following:

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike and matrix spike duplicate results

- Laboratory control sample results
- Surrogate recoveries

The results were evaluated in the context of the requirements of the project QAPP and/or laboratory SOPs, where available and applicable. Unless specific comments are made, there were no problems associated with a given evaluation criterion.

### **Data Completeness**

Since this is a Tier II validation effort and therefore did not involve an examination of all of the raw data, there may be some raw data that are not present in the package.

### **Calibrations**

Initial calibrations and continuing calibrations were performed as required. The results for two of the continuing calibration standards included several analytes that demonstrated a difference of more than 25% between the amount found and the true concentration of the standard. However, in most such instances, the results for the same standard analyzed on the other GC column were within the acceptance limits. Therefore, the laboratory reported the results for those analytes from the GC column that met the specifications.

The only exceptions were for the continuing calibration standards analyzed on 5/14/99 at 9:57 PM and 5/15/99 at 4:24 AM. For both of those standards, the results for PCB 18 and the surrogate compound DBOB were lower than expected, with %D values of -26% to -31% on both columns in both standards. The calibration results for the surrogate are not critical, since the surrogate recoveries for all the samples were well within the acceptance limits. The results for PCB 18 suggest that there may be some slight low bias in the affected samples.

SAIC has reviewed the specific results for the three tissue sample analyses that occurred between these two calibration standard analyses. The affected samples are D-6-TISS-SMP, HB-9-TISS-SMP, and the matrix spike duplicate aliquot prepared from sample D-4-TISS-SMP. The PCB in question was not detected in either of the unspiked samples. Therefore, given the slight potential low bias, the results for this compound in samples D-6-TISS-SMP and HB-9-TISS-SMP have been flagged "UJ" to indicate that the reported detection limit may be an estimate.

There is no apparent effect on the matrix spike duplicate results, since the recovery of PCB 18 was well within the acceptance limits and the RPD between the MS and MSD results was only 2%. Therefore, no qualification of the MSD results is required due to the calibration results.

### **Comparisons Between Results from Two GC Columns**

SW-846 Method 8000B recommends that the quantitative results from both GC columns be compared during dual-column analyses such as used here for the PCBs. As noted by the laboratory, there were a number of instances in which the quantitative results from the two GC columns used for the analyses differed by more than 40%. In those instances, the laboratory reviewed the chromatograms and if no evidence of a problem was found, they took the conservative approach and reported the higher of the two results, flagging those values with a "P" to indicate that the higher value was reported.

If, after examining the chromatograms, they found evidence of a positive interference on one of the columns, or if there was evidence that the baseline had been incorrectly established by the software, the laboratory reported the lower of the two results, flagging those values with a "T" to indicate that the lower value was reported, due to an interference.

SAIC has reviewed the chromatograms for these samples and agrees that the laboratory's reported results were appropriate and there is no need for qualification of the results.

#### **Overall Assessment**

Overall, the majority of the results for these 9 tissue samples meet the objectives of the sampling and analysis effort and they may be used without qualifications.

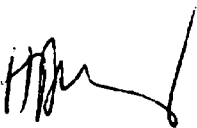
The reported quantitation limits for PCB 18 in samples D-6-TISS-SMP and HB-9-TISS-SMP are considered to be estimates and should be flagged "UJ."

**APPENDIX C-4**  
**1, GRAIN SIZE, TOC, AND AVS**



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## MEMORANDUM

**Date:** June 17, 1999  
**To:** Greg Tracey  
**From:** Harry McCarty   
**Subject:** Raymark 1999 Sediment Data Validation  
Sediment SEM data for 17 samples

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As requested, I have reviewed the results of the 1999 Raymark sediment data for simultaneously extracted metals (SEM). The analyses were performed by the University of Rhode Island (URI) Paleomagnetism Laboratory on 17 sediment samples collected by SAIC in April 1999. The laboratory used the SAIC sample numbers, as shown below:

SAIC Sample ID	
C-1-SED-SMP	D-6-SED-FD
C-2-SED-SMP	E-1-SED-SMP
C-3-SED-SMP	E-2-SED-SMP
D-1-SED-SMP	E-3-SED-SMP
D-2-SED-SMP	E-4-SED-SMP
D-3-SED-SMP	F-1-SED-SMP
D-4-SED-SMP	F-2-SED-SMP
D-5-SED-SMP	F-3-SED-SMP
D-6-SED-SMP	

While an attempt was made to perform a Tier II validation, using the EPA Region 1 data validation guidance, the level of validation that was possible for these results was very limited. The methods employed have relatively few quality control steps associated with them and the data reported by URI are limited to tabular summaries only.

Our review efforts evaluated the summary level data only, and considered the following (where applicable):

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks

- Matrix spike results
- Duplicate samples
- Blank spikes

The results were evaluated in the context of the requirements of the laboratory SOPs, where available and applicable.

### Blanks

The laboratory reported the results for the procedural blank on a weight basis (e.g.,  $\mu\text{g/g}$ ) and those results have been used to evaluate the associated sample results. The procedural blank run for the SEM analysis found copper, cadmium, and nickel at levels above the levels found in many of the sediment samples. Zinc and lead were reported in the blank at levels that exceeded the results for a single sample each. The source of these metals in the blank is unclear. The calibration blanks run for each metal do not indicate that the instrument is contaminated. The levels reported in the blank do not appear to be a systematic problem. However, since many of the sample results are lower than those found in the blank, there is no means by which to determine if those low level sample results are real or the result of contamination from an unknown source.

We recognize that the SEM data are not used in the same fashion as data for total recoverable metals might be. Therefore, it is difficult to establish a firm set of rules for evaluating the SEM results relative to the observed blank results. The traditional "five times" rule would qualify any sample result that was not at least five times greater than the blank result. Using that rule, most of these SEM data would have been qualified.

Therefore, the reviewers have used the approach of qualifying all SEM results that are less than or equal to the observed blank results. Using this approach, the following results are qualified as estimates (flagged "J"). The results for the seven samples not listed in this table were *not* qualified as a result of the observed blank results.

Sample	Copper	Zinc	Lead	Nickel	Cadmium
C-1-SED-SMP	3.4 J			3.2 J	0.14 J
C-2-SED-SMP	7.7 J				0.10 J
C-3-SED-SMP				4.8 J	0.13 J
D-1-SED-SMP	4.1 J		3.3 J	2.7 J	0.18 J
D-2-SED-SMP	3.5 J			4.7 J	
D-4-SED-SMP		6.5 J			
D-5-SED-SMP	6.5 J				
D-6-SED-SMP	4.6 J				
D-6-SED-FD	11.1 J				
F-2-SED-SMP	6.9 J				



## Matrix Spike Results

The DQOs provided by URI indicate that matrix spikes are not applicable to this analysis and are not included in the laboratory's SOP. However, because they were requested by SAIC for this project, URI provided data for both matrix spike and blank spike analyses. SAIC reviewed those data, and while there are no acceptance limits, the reviewers are concerned that the recovery of lead is only 55% in both the matrix spike and the blank spike. Given the identical results for the matrix spike and the blank spike, there is not an issue of a "sample matrix effect." These results raise concerns for the lead results in each sediment sample. The recoveries of the other four metals were all within a range of 90-115%.

Based on discussions with the laboratory, they believe that the relatively strong HCl concentration in the sample extracts may suppress the response for lead when using graphite furnace atomic absorption. The reviewers cannot rule out this possibility, but the issue remains that the results for lead may have a significant low bias. Therefore, all of the SEM results for lead have been qualified "J" as estimates.

## Duplicate Samples

The laboratory's DQO for the precision of duplicate analyses was not met. The DQO calls for the relative percent difference between the duplicate analyses to be <30%, with an allowance for no more than 35% of the analytes to exceed that 30% limit. Of the five metals studied, three (60%) of them (copper, nickel, and zinc) exhibited RPD values in the range of 56-78%. It is important to note that these measurements were performed on duplicate aliquots of the same sample (C-1-SED-SMP) and *not* on the field duplicates collected by SAIC. The degree of blank contamination exhibited may also explain *some* of the relative imprecision observed for the duplicate analyses, since the results for copper, cadmium, and nickel in *both* the original sample and the duplicate sample were below the blank levels. However, even though the zinc results were 9 to 20 times the blank result in the sample and the duplicate, this analyte still had an RPD of 78%, indicating that the blank is not the sole contributor to the precision problems.

The sample chosen by the laboratory for the duplicate analysis was C-1-SED-SMP. The grain size data for this sample indicate that it was a coarse-grained sediment, with 78.6% sand. The laboratory believes that the coarse nature of the sediment made it very difficult to take replicate aliquots for the duplicate analyses, thus leading to the observed imprecision of the SEM results. While the grain size distribution may in fact be the cause, 8 of the 17 sediment samples were >70% sand. The reviewers also note that the other two metals, cadmium and lead, had RPD values of 7% and 1% respectively. Therefore, it cannot be the grain size alone that is determining the duplicate precision.

Whatever the cause, the results of the duplicate analyses suggest that the results for copper, nickel, and zinc may not be very precise.

## Overall Assessment

Except for the four results noted in the discussion of the blank results, the SEM data for cadmium may be used without qualifications. The cadmium data for C-1-SED-SMP, C-2-SED-

SMP, D-1-SED-SMP, and D-2-SED-SMP are qualified as estimated ("J") due to potential blank contamination.

All of the results for lead are qualified as estimated ("J") due to the low recovery of this metals in both the matrix spike and blank spike analyses. The lead results in D-1-SED-SMP is also qualified as estimated on the basis of the blank results.

All of the results for copper, nickel, and zinc are qualified as estimates on the basis of the observed precision of the duplicate sample analyses. The results for many of these samples were also qualified as estimated due to potential blank contamination. See the table in the discussion of the blank results for the specific results that were qualified as estimates.



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## MEMORANDUM

**Date:** June 11, 1999

**To:** Greg Tracey

**From:** Harry McCarty

**Subject:** Raymark 1999 Sediment Data Validation  
Sediment Grain Size, TOC, and AVS data for 27 samples

As requested, I have reviewed the results of the 1999 Raymark sediment sample data for:

- Grain size
- Total organic carbon
- Acid volatile sulfides (AVS)

The analyses were performed by the University of Rhode Island (URI) Paleomagnetism Laboratory on 27 sediment samples collected by SAIC in April 1999. The laboratory used the SAIC sample numbers, as shown below:

SAIC Sample ID		
C-1-SED-SMP	D-6-SED-FD	HB-2-SED-SMP
C-2-SED-SMP	E-1-SED-SMP	HB-3-SED-SMP
C-3-SED-SMP	E-2-SED-SMP	HB-4-SED-SMP
D-1-SED-SMP	E-3-SED-SMP	HB-5-SED-SMP
D-2-SED-SMP	E-4-SED-SMP	HB-6-SED-SMP
D-3-SED-SMP	F-1-SED-SMP	HB-6-SED-FD
D-4-SED-SMP	F-2-SED-SMP	HB-7-SED-SMP
D-5-SED-SMP	F-3-SED-SMP	HB-8-SED-SMP
D-6-SED-SMP	HB-1-SED-SMP	HB-9-SED-SMP

While an attempt was made to perform a Tier II validation, using the EPA Region 1 data validation guidance, the level of validation that was possible for these results was very limited. The methods employed have relatively few quality control steps associated with them and the data reported by URI are limited to tabular summaries only.

Our review efforts evaluated the summary level data only, and considered the following (where applicable):

- Data completeness
- Holding times
- Calibrations (initial and continuing)
- Blanks
- Matrix spike results
- Duplicate samples
- Blank spikes

The results were evaluated in the context of the data quality objectives (DQOs) provided by the laboratory, where available and applicable. The results of this review are described below, by analysis type.

#### **Grain Size**

All of the data quality objectives provided by the laboratory were met for this analysis.

#### **Total Organic Carbon**

All of the data quality objectives provided by the laboratory were met for this analysis.

#### **Acid volatile sulfides (AVS)**

All of the data quality objectives provided by the laboratory were met for this analysis.

#### **Overall Assessment**

The data for these 27 sediment samples met the laboratory's DQOs and may be used without qualifications.

The results for the field duplicate pair D-6-SED-SMP and D-6-SED-FD in sediment set 2 support the concerns about the field duplicates that were expressed in the reviews of other analyses. The data for grain size, total organic carbon, and AVS all differ markedly between these two samples. The field duplicate pair from sediment set 1, HB-6-SED-SMP and HB-6-SED-FD, were not analyzed for AVS, but the grain size and total organic carbon data differ greatly between these two samples as well.